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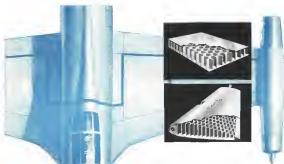
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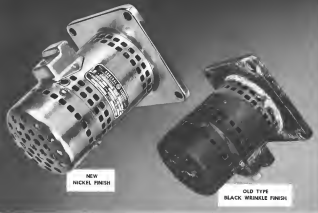
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24 KARAT

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A black and white photograph showing a diverse fleet of military aircraft in flight. The composition includes several fighter jets at the top, a large four-engine bomber in the upper left, a transport plane in the center, and two helicopters at the bottom. The aircraft are arranged in a loose formation against a backdrop of soft, white clouds.

Left to right: from top to bottom: Midwayall F 101; North America F 100; French F 101A; Boeing B-71; North America F14, F 101, and F 101B; Lockheed F 100; Douglas B7 F; Shorts S 24 and S 26

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J. O. (13) Nathan, Jr., also president
served in the president, Radiophone Co.
Inc., Van Ness, Calif.

Gordon M. Eide, vice president of Northwest Orient Airlines, former executive vice president of Ellicott Systems.

Karl W. Hults, vice president in charge of Dayton Ohio, operations, Cool Electric Co., Chicago, Ill.

Charles D. Masket, assistant to the president coordinating aircraft sales for Boeing Aerospace Corp. division. Earl F. Kellerman,

Executive Producer: William J. Schallert
Associate Director: Sylvia Fleming, Gary
Becker, Avram Corp., and Paul Robert E.

Richard S. Fisher, executive, training sales supervisor, *Stratlin Radio*

F. H. Ginterman, assistant vice president,
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Leonard S. Blumenthal, executive assistant to vice president, Fairchild Camera & Im-

B. B. Goss, assistant vice president of

and public relations administration, United
Age Lines, Hester J. Merchant, head of the
radio department.

J. A. McDiarmid, general manager, Canadian Steel Improvement Ltd., Toronto.

subsidiary of A. V. Roe Canada Ltd., are
revolving C. J. Lahey, president; general man-
ager, also owner, Clifford May; H. D. S.

Group Capt R. H. E. Lumsden, director

H. Ford, Air Commodore Leonard Taylor

senior staff officer, Maintenance Command
R.A.F., with acting rank of air vice-marshal

Dr. George E. McCullough, manager process development, General Electric Co.'s chemical development department, Pittsfield, Mass.

Ernest E. Baker, Jr., Electronics Division manager, Chubb-Patterson, Inc., Akron, Ohio.

Dr. Eugene B. Johnston, project engineer, surveys and equipment for medical as-

James W. Nelson, Jr., manager and De

William A. Edson, traveling inspector
General Electric Co.'s Milwaukee Sales
and Service District, Oak Ridge, Tenn.

Calif. Nelson succeeds H. E. Chaffield Jr., recently promoted to general manager. In

General Computer System, C/I Technical Products Dept., Syracuse, N. Y. Orville L. Miller, materials manager, contacts are below.

Edward W. Rex, advance planning man-

Charles W. Taft, liquid propellant is much more convenient, contact mouth design

ment, Wyandotte Chemicals Corp., Wyandotte, Mich.

*Douglas Doug Deng air-to-air missile with a nuclear warhead will use a liquid fuel inlet system being developed by the Rocketdyne Division of North American Aviation, Inc.

► Facing Airplane Co. will make its bid for a supersonic bomber with its project 110, utilizing new chemical fuels, rather than the larger version of the B-52 powered by Pratt & Whitney F75 turbojets. Even with the 15,000 lb. thrust F75 turbojets the B-52 will remain obsolete.

► Protogen is taking a new look at the Comstar B-55 supersonic bomber program now that it is almost certain the design competition for a new tactical bomber will be cancelled, due to limitations on USAP research and development funds (AW Feb. 15, p. 28). Tactical Air Command teams have been studying Convair's Ft. Worth, Tex., plant assessing the B-55's structure and prototype under construction. Prototype is scheduled to make its first flight next fall.

*Egyptian air force has received about 30 MiG-28 twinjet light bombers from Czechoslovakia. The Russian-designed planes are being assembled at Almaz at the rate of about one per week and about one dozen have been completed to date. The Egyptian air force will be completely dependent on Czech supplies of bombs and ammunition as well as spares.

►First production model of the Lockheed F-104A, powered by a General Electric J79 turbojet, made its aerial debut from Edwards AFB last week.

■ Air Force has successfully tested its ground-to-air "data link" which will enable an defense SAGE computer to automatically direct interceptors into the vicinity of the target, where their own airborne radar can take over the targeting guidance. The USAF "data link" system, developed by General Electric Co. provides only the ground-to-air data transmission. Improved system, now under development, permit two-way data transmission.

• An aerial bombing system, which can operate without need or refer-
ence to the ground, is under design for the Air Force. The new system,
developed by the Massachusetts Institute of Technology, has been turned
over to A. C. Spark Plug division of General Motors Corp. for production
design.

► Cosma expects to fly its prototype Model 620 low-engine executive transport in April. Tests on the pressurized fuselage have been completed and major sub-assemblies are nearing completion at Wichita.

► ARINC has given Technical Program Flowing Documents to six manufacturers seeking development of an improved language menu "vehicle." The word would have a helicopter's ability to hover and run vertically, but forward speed will be far greater than now possible with rotary wings.

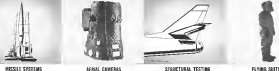
► A Saurer Alouette II helicopter, powered by a Turbomeca Astromec turbine engine crashed and burned in southwest France earlier this month. Cause of the accident has not been determined. Two prototype and three pre-production models of the helicopter have been built. Full production is expected to start in March.

► Air Force Mustang Scorpions bring out all known AFB, Mich., as springing service needs while still airborne. The pilot makes by code transfer the servicing requirements, such as, fuel, fuel, engine or instrument, and operators are on hand with tools ready when the airplane lands.

*An Air Force evaluation team has accepted Phase One designs for the long-range intercept competition among North American, Northrop and Lockheed. A decision on competition was made by May 1.

► Sweden's Roe supersonic interceptor is scheduled to use two de Havilland Cirrus wing turbojets and one de Havilland Six engine rocket engine.

REM-CRU TITANIUM, INC., MIDLAND, PENNSYLVANIA

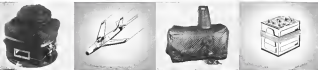


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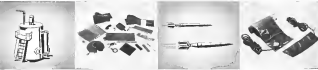


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Washington Roundup

Research Victory

Although Trevor Gardner's request for \$250 million more in USAF research and development funds had the support of the Air Staff in addition to distinguished USAF advisors such as Brig. Gen. Charles Leach, Jr., Dr. Theodore von Kármán and Dr. Casimir Szever, USAF Secretary Donald Quarles vetoed it. Now Quarles is yielding to USAF pressure and has agreed to a project by project review of its research and development projects, and has indicated he will back a request for additional funds. Reel parts in that about \$80 million will be added to USAF's Fiscal 1972 budget. Some of the work will come from Defense Department's emergency funds and some is likely to come from a supplemental budget request.

Rothschild's Mistake

Leon S. Rothschild, Commerce Undersecretary for Transportation, and that he personally was to blame for the "leak" on new airport projects totaling \$35 billion, which had aroused the ire of Democratic leaders in Congress (AWF Feb. 20, p. 25). He admitted at a Senate Commerce-Airline Subcommittee hearing that he gave a list of the airport projects to the Republican Congressional Campaign Committee since 15 hours before it was made public. The list, Rothschild said, was given to William Warner, committee director. The entire works for the election of Republican House members. Most GOP House members were tipped in advance of their Democratic colleagues on the situation.

"If there was a mistake made, it was mine," Rothschild said in testimony to a question from Sen. Mike Mansfield (D-Ore.). "If I'm still around when the same thing comes up again, I'll be a little smarter than I was last time." He added.

Quarles' Detachment

USAF Secretary Donald Quarles, who is leaving in formal problems with the professional military leaders of the Air Staff and some of his civilian assistants over the size of the Fiscal 1972 emergency budget, recently left the House Appropriations Committee.

"I often for me carries a certain amount of detachment from the Air Force rather than looking at it just as an Air Force matter."

Missile Roles

Gen. Nathan F. Twining, USAF Chief of Staff, testifies before the House Appropriations Committee that the service responsibility for operating intermediate-range missiles has not been assigned by the Defense Department, although USAF and a joint Army-Navy team have been assigned BDM development studies. Gen. Twining said USAF had been assigned operational responsibility for the intermediate-range ballistic missile (ICBM) and was getting ready to organize combat units trained to use the ICBM as soon as it is available.

Security Snafu

The month's top security snafu, which resulted in first Defense Department release of unclassified photos of Rabinovich and Sherk, resulted late last Monday, has resulted in another error from Secretary Charles E. Wilson.

son that probably will curb on new movements to the general press in fact to best a national picture magazine in the meantime, but not soon enough to prevent lead protests from the Pentagon's regular press corps. A few days earlier, while the Department was trying to make up its mind what to do over Army, Navy and Air Force sources were told in a White House memo that "all photographs or sketches of new weapons projects, new equipment and new aircraft shall not be disclosed by the services, at least overseas in headquarters, for access for publication until approved by the Office of Security Review in the Office of the Assistant Secretary of Defense (Legislative and Public Affairs)." Effect of this could be to delay declassification where circumstances make it necessary because of condition precedent to an aircraft plant's export or test facilities. The correct security, responsible for the contract and classification, could not so specific with an aircraft company in need of declassification in order to meet on engineering, security, personnel or sales problems.

Honor for Billy Mitchell

The Army, with the approval of the Department of Defense, is backing legislation to confer the rank of Major General on the late Billy Mitchell.

It was 10 years ago—Jan. 25, 1925—that the old War Department issued court martial orders against Mitchell. "He be suspended from rank, command and duty with forfeiture of all pay and allowances for five years" as an outgrowth of his outspoken advocacy of airpower. Mitchell held the permanent rank of colonel and the temporary rank of brigadier general prior to his suspension Jan. 1, 1925.

Pyle Named CAA Deputy

James T. Pyle, 42, civil aviation advisor to the Assistant Secretary of War for Air, has been named Deputy Administrator of Civil Aviation. His is slated to join CAA on Mar. 10, three months to the day since Charles J. Lorenson moved up to the Administrator's spot from the number two CAA job.

Pyle, like Lorenson, is a pilot and a Republican. He was a World War II Navy pilot and has been various administrative posts with Pan American, World Airways.

The new combination should give CAA the good, top-level working team that it needed, elements say. Lorenson has now gotten the feel of his job and Pyle can step right in to his deputy, being already familiar with the Washington scene and the problems CAA faces.

Lorenson says he has found in Pyle the kind of deputy he wanted—one who can step into his job if necessary.

Final selection of a deputy administrator should manage other CAA management changes that have long been indicated. The new aggressive leadership being demonstrated at CAA should substantially improve the morale of the rank and file.

First major reorganization will be to make an office control independent of the Federal Aviation Board. Donald D. Thorne, deputy director of air ops, is the only member of the organization's management division. Thorne will be a staff officer background. It is also expected that the aircraft engineering division, presently headed by W. H. Weeks, will be given separate status from aviation safety.

—Washington Staff



McDONNELL F-101A: Gen. Twining believes this USAF fighter would be more than a match for Russia's Bison heavy bomber in the event of war. In above picture, the F-101A makes three Hughes Helios air-to-air circles (shown) on page 29. By Secretary of the Air Force Donald A. Quarles is one of USAF's two paid members in the profession (right) and two classes of intelligence roles.



NORTHROP F-5A: Only long-range U.S. aircraft available in production quantities, could become an economical delivery system with maximum effort and time. Flight tests have shown accuracy of Mk. 12 aerial guidance system incorporating gyro-compass. F-5A can be carried in jet-to-rocket wing tanks. Storm is powered by an Allison turbojet, is comparable in size to a light bomber.

Russians Outpacing U.S. in Air Quality, Twining Warns Congress

USAF Chief of Staff says research and development effort paying off; Bisons outnumber B-52 bombers.

By Claude Wines

Washington—Soviet Russia's air force, already larger in thousands than that of the United States, is not overhauling our lead in quality—largely through in earnest research and development efforts—Congress was warned last week.

In the harshest assessment of Soviet capabilities given to the public by the U. S. Air Force, Chief of Staff Nathan F. Twining told the Senate Armed Services Committee:

• Russia has more Bisons than this country has B-52s and can keep the advantage.

• USAF has more B-16s than Russia has B-16s, their turbojet heavy bombers, but Russia could pass the U. S. in this category in the next two years.

• USAF has many more B-47s than Russia has B-47s, the comparable medium jet bomber.

• Russia has thousands more jet fighters than the U. S. has B-57s.

• Russia has thousands more jet fighters than this country has.

• USAF has more jet fighters than Russia has F-101s but they could close this gap in two or three years.

On top of this, Gen. Twining declared, USAF does not have in present

combat wings of top effectiveness. The reason for this is lack of operation and maintenance funds.

"I want to emphasize," he told the Senators, "that operation and maintenance money can be the difference between an effective and non-effective combat force. There is no point in spending billions of dollars for an

weapons system and then if we are not going to have enough money to maintain and operate them properly—money to pay operating costs, money to maintain our bases, money to buy the fuel, spare parts and supplies we need to keep the Air Force operating."

Bigger Budget Ahead

Gen. Twining did not turn his back on the proposed budget for Fiscal 1957. Like USAF Secretary Donald A. Quarles, he said, he supported it, but his statement left no doubt that he considers the United States at a critical point in the arms race, handicapped by complexity and lack of money and research and development effort.

He said the proposed budget needs careful study on a maximum basis and that a bigger budget will be necessary for Fiscal 1958.

It looks like the Committee could catch up, Gen. Twining said. "If they continue their rapid pace it may be necessary for us to speed up."

On the subject of research and development, the General said the Russians are putting "more men and money into the battle of the laboratories than we are."

"The greater effort could also result in the Soviets obtaining better results sooner than we."

ICBM Production

He predicted that they could make good on their threat to have an anti-

continental ballistic missile in the near future.

Gen. Twining started his presentation with a frank admission that the Russians maintain an output rate out of proportion to their capabilities. He recalled a recent picture given in Congress last June, after the spring bomber demonstration of Soviet aspect, and the step-up in aircraft production recommended at that time.

On the overall aircraft picture at this time, Gen. Twining said, "They either have a surplus in quantity, or can overtake us, in all categories of war planes except that of the medium jet bomber."

However, he said, "it is their push for quality that is of even greater concern."

In this connection, he said the B-52 and B-70 jet bombers compare favorably with our B-52 and B-70, although USAF retains a "slight edge" in performance.

Serial Improvements

He pointed out that our rebuilding capability and foreign bases add to USAF's effectiveness but "it would be imprudent to assume that the Soviets cannot conduct aerial refueling operations." The general said he is convinced that we are ahead of the Russians in this technique.

The Chief of Staff said the Russians are handicapped in the field of nuclear bases and the direction from which they can launch attacks but they "are

taking steps to correct this." The improvements include more bases, land around and expanded in Eastern Europe and the Far East.

Also, he said, there are new facilities in the satellite areas, China and the Arctic.

He said the Russian development of Arctic bases "indicates a determined effort to develop delivery systems capable of handling long range aircraft all along the perimeter."

When these Arctic bases alone, the Soviets could launch several hundred long-range bombers in a single attack.

The general estimated that the new Russian turbojet bomber the Bear, his representative name. This is a capability that the Reds did not have two years ago, and it comes at us not only on the B-16, but also on the B-16, and have not taken steps to provide a turbojet substitute.

Other major points made by Gen. Twining in his statement to the committee include:

• USAF's experience in long-range operations should help us to ready our organization, more rapidly than Russia can prepare for war.

• Soviet air defenses are improving fast, particularly with their first production of all-weather interceptors. They mean the U. S. attacking force, in event of war, must meet more severe losses.

• The current armaments that USAF will get, such as the F-101 intercepter, F-102, and F-104, will place the U. S.



GEN. NATHAN F. TWING

is a much better defensive position. • USAF's transport capability will get a boost by Fiscal 1957 and even further outpace the Russians in this category.

Nuclear Weapons

On the subject of nuclear weapons, Gen. Twining declared we have no biggest advantage but again "the Soviets are making impressive efforts."

The general then gave the comparison:

"Our own defense and Soviet attack capabilities are both increasing. By the time the Soviets have a bomber force large enough and effective enough to wage a global war, our defenses will be formidable."

Our own defense and Soviet attack capabilities are both increasing. By the time the Soviets have a bomber force large enough and effective enough to wage a global war, our defenses will be formidable.

Fighters vs. Bombers

"Our present F-100 would be effective against the Soviet Bison, compared

the years from now as well our manned bombers.

I signed an highly misleading and damaging to our whole position here the line of publicity that says that an ultimate reason that we have no defense against it is that the first fellow that gets it is going to be us and the last night is will show up their heads. This is a line at risk I deplore. I think it is a mistake and possibly more so in a United States that, faced to us as with the possibility that somebody will say "Why don't you throw up your hands?"

Let me explain why I think it is a mistake. I think we have to have plans of weapons range bombers that have all the bases in Europe that we are talking about within their range and that have the capability of delivering their bombs against these bases with more precision than we expect them to have with a ballistic missile for some time to come.

Therefore they know and we know that the more accurate that these are and the more accurate that we are, the more the balance of power between the two blocs. They know and we know that until they have an effective means of knocking out our capability, power before it can get off the ground, then they do not have a sound basis for starting a war. And they know that the addition of even an intercontinental missile of any accuracy that they are apt to have within the next decade will give us a strategic advantage in them over their bombers.

"Moreover we know that we will have B-52 bombers that are due a much better job for sometime to come than anything we have to do with missiles of any kind. We will also have very interesting guided missiles that will have range and precision and load carrying capacity at least equal to the ballistic missile of our better, and some of them will be as difficult to intercept that I would expect five odds to get through to be comparable though not equal to the ballistic missile.

"The point I am making is that we have given the this unsound line of perspective. We have scared our people to think about something that to be sure is a haunting weapon. But it does not tell you are clearer than a bomb does with an atomic bomb. No body is going to start a war because they have this kind of weapon unless they can use a war out that will avoid destruction of themselves. The addition of this weapon to their arsenal, whether it is or not we have it, will not avoid destruction to themselves.

"We are recognizing it (the ICBM) as a very potent addition to our arsenal but we are not recognizing it as a weapon that will avoid being neutral, whichever side gets it first."

Gardner Says Budget Guarantees Nation 'Second Best Air Force'

Washington—"The Fiscal 1957 budget will guarantee the United States the second best Air Force in the world."

This statement as a national television speech by James Gardner, who recently, appointed as Assistant Secretary of the Air Force for Research and Development, closed a week of testimony before Congressional committees that touched off the most bitter debate over military spending the Capitol has seen since the Congressional investigation of the B-56 program in 1949.

Among the other statements made by Gardner during last week.

• Russia is ahead of the United States in the ballistic missile development race.

• Boeing B-52 production program should be halted to produce about 45 of the long-range jet bombers a month.

• Russia is developing the U. S. in aircraft development at an alarming rate.

• USAF needs a total budget of about \$20 billion including an additional \$500 million for search or weapon systems development in aerial weapons systems development.

• Missile program needs a congressionally authorized cost to operate a "crash" program aimed at producing maximum results in minimum time.

Gardner Fiscal 1957 budget as submitted to Congress is about \$13 billion less than the Air Force specified as necessary to continue its expansion and modern combat-ready forces.

Responding for the lack of sufficient funds in the Fiscal 1957 budget tests squarely on President Eisenhower, Defense Secretary Charles E. Wilson, USAF Secretary Donald A. Quarles and the Bureau of Budget, all of whom, according to Gardner, failed to support the USAF program.

Gardner gave the House Appropriations Committee an executive session the first complete picture of the budget situation, saying that each USAF program with a \$16.5 billion Fiscal 1957 request to Congress. Original USAF budget designed to carry out authorized expenses to 137 combat-ready wings, push research and development of a pace to improve the Bureau and modernize the USAF front line aircraft inventory with the new weapons was computed at \$23 billion. USAF requested that figure for the fiscal year because of the Defense Department budget ceiling imposed by the Bureau of the Budget in its effort to produce a balanced national budget for Fiscal 1957.

Consequently, according to Gardner, USAF paid its budget request to \$18.5

billion for intervention in the Defense Department. Secretary Wilson then pared this by another \$2.5 billion to the \$16.5 billion sent to Congress.

Consequently, according to Gardner told the committee that the Defense tests launched on about \$1 billion for aircraft procurement, \$500 million for other procurement including major and minor for the SACG, air defense environmental systems, \$400 million for operations and maintenance and \$500 million for base construction and research and development.

USAF has been operating under a Defense Department-imposed budget ceiling for its research and development effort for the past three years, Gardner said. He pointed out that this budget ceiling was imposed despite tremendous progress being made through a series of successful test programs that allowed operations to progress the Bureau past in aerial weapons development.

He said that ample funds were available for development of the intercontinental ballistic missile (ICBM) and the intermediate-range ballistic missile (IRBM) but that these funds were available only because they had been diverted from the semiautonomous search program on ground search.

Gardner said that the principal problem in pushing accelerated research and development was getting sufficient money to exploit scientific progress.

"Technological breakthroughs are occurring at a rate that appears to be faster than the ability of our defense making machinery to adjust to them," he said.

He promised to provide the first Congressional Committee on Armed Forces with a specific set of recommendations for speeding the development program in guided missiles.

"We have three services competing in the ballistic missile field," he said.

"We have put out our test wings and they compete for test time. At the three services move into this field more and more with no coordination or funds there needs to be some central authority to coordinate the activities of the three services and direct the kind of program and involve the kind of problems that are encountered."

Gardner said that he had talked to President Eisenhower on the missile program under "control" conditions that make it impossible for him to present a complete and accurate picture of current program and problems.

"I didn't consider the short time I had (with the President) permitted me to convey the true picture to him," he said.

Army's Redstone

STATIC FIRING of Army's Redstone missile (right) follows its suborbital test stand at the Redstone Arsenal in Huntsville, Ala. The proximity of the stand indicates that two static tests can be made simultaneously. Firing and checkout of Redstone (below) is carried out in this gallery before long. Missile tests have been made at Air Force Missile Test Center, Patrick AFB, Fla. by Army Ordnance teams. First launch of the 4th missile was made in May 1955.



REDSTONE tests speed in this extremely stretched picture of the surface-to-air missile. Developed by a group of ex-Germans, missiles from Peenemunde under technical direction of Army Ordnance, Redstone has a range comparable to the old V-2, opened in Sept. 1944. Redstone development program could lead to two-stage missile with 1,500 mi. range.

Profit Hearing May Mean New Legislation

By Katherine Johnson

Washington—Congressional hearings on the profits of defense manufacturers are expected to lead to new government legislation.

The first companies to testify before the House Armed Services Investigating Subcommittee, headed by Rep. Edward Hebert (D-La.), were North American Aviation, Inc., the Martin Co. and Boeing Airplane Co.

Developments of major consequence to the industry that may be watched for are:

- Comparison of the procurement treatment of the different firms. That would include the cost allowed for top management salaries and other overhead, based on business volume. It is understood that some firms with more the business have management cost allowances half those of other defense firms.

- Comparison of Air Force and Navy records with industry figures. It is understood that some of these differ. The subcommittee's plan is to take from some of the 15 defense companies first, and then hear representatives of the service.

- Repeal of the Renegotiation Law, with its vague criteria for adjusting excessive profits.

Renegotiation

Discontent with the service, the arbitrators, and the demands of operation of the Renegotiation Board is widespread in Congress. The Senate Small Business Committee, reflecting the position of small industries in opposition to large business now is launching its investigation of the matter, due in early Dec. 51.

It is recognized, however, that particularly in an election year, Congressmen are not likely to demand the renegotiation control on profits without some kind of replacement to take care of predominantly Government contracts.



WILLIAM H. ALLEN (left), Boeing Airplane Co. president, and Robert C. Stearns confer during House Armed Services Investigating Subcommittee hearing on profits.

ties operating under negotiated contracts.

One outcome of the Hebert hearings may be legislation setting uniform standards on negotiated Government contracts, spelling out the amount of profit allowable on the basis of sales volume, on the basis of private invested capital, or on the weighted average of both of these.

North Americans, Boeing

There is also the prospect that the sales, advertising, association contribution allowances, and other overhead of firms doing a major percentage of business with the Government would be limited.

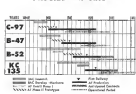
At the initial session, J. L. Atwood,

president of North American, and William Allen, president of Boeing, emphasized the low profits of their companies, based on sales volume. George M. Butler, assistant chairman but did not make a special presentation for Martin, which he heads.

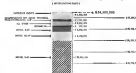
North Americans made 3.6% profits on sales in 1954, compared with the manufacturing average of 5.9%. As Congressmen, the profit on sales of General Motors Corp. was 9.1%; du Pont de Nemours Co., 28.4%; Standard Oil of New Jersey, 10.1%.

Boeing's profits averaged 2.4% of sales during 1952 through 1954, compared to 10% for the chemical industry and 5.6% for the automotive industry. Clyde Skuse, controller of Boeing

PROGRAM PHASING



Profit from Renegotiable Business by Source, 1952



FOUR TABLES above were prepared by Boeing for committee hearings. Table at top left shows how large between initial contract and delivery of four aircraft; top right, with cost of B-52. Bottom tables show Boeing's renegotiable business and contract-type contracts.

held the subcommittee that earnings on sales "is the most successful comparison to use if you negotiation to actual work accomplished and effort expended."

Developments during the questioning included:

- Rep. Hebert declared that North American is a "Government subsidiary," saying Government property and Government business is not private profits. He made the statement when Atwood pointed out that the company's \$750,000 advertising budget for this year would be paid out of profits and not charged to a cost account Government contracts. With 99.66% of North American's business coming from the Government, Hebert commented, "The money all comes from the same source. It's just a case of Twentieth and Twentieth."

- Rep. George Miller (D-Calif.) agreed that there is no real reason for North American to spend money for advertising that for the National Aeronautics and Space Act.

Miller suggested that the Government handle advertising through the de-facto stage, and then "firm out the construction" to a

competitive industry. Atwood objected that the bureaucratic type of organization would not be efficient and that private industry, with the profit center, is "by far the best means of designing and developing aircraft." Atwood conceded that National Advisory Committee for Aeronautics had been a success, but pointed out that it is limited to Government projects.

- Rep. Leon G. Davis (R-Va.) protested the lowest prices on the use of Government facilities by defense firms, charging that it put competitors at a disadvantage. Atwood pointed out that cost charged would simply become costs on Government contracts.

The theoretical procedure of the subcommittee is to (1) present the witness company to make a presentation, (2) develop details on individual contracts, and the overall company financial position, through questioning by Subcommittee Counsel John Courtney, and (3) allow questioning by committee members.

Plane Breakdown

Details developed on North American and Martin type were:

- North Americans. The unit price of

the B-54D was \$551,000, with \$18,515 allowed in profit. On subsequent model, the price was \$1,400,000 and \$18,515,47, with \$5,511 profit. B-54B, \$468,790, with \$37,131 profit.

The unit prices and profit allowances on other types were: 1,000A, \$805,954, with profit of \$57,437; A-1, \$1,500, \$1,512,577, with loss of \$55,570; A-1P, \$593,594, with profit of \$302,700; A-1, \$714,945, with profit of \$65,472; A-1P, \$1,481,945, with \$47,941 profit; F-1, \$1,500, \$1,504, with \$16,767 profit; F-1A, \$1,512,667, with \$28,168 profit; F-1B, \$1,512,667, with \$4,855 profit; F-1B, \$1,512,667, with \$7,474 profit.

- Martins. The unit cost on the first eight B-57s, including plant tooling costs, was \$8,996,515, it was \$12,313,529 on the follow-on order for 57 planes. The profit allowance per unit was \$117,440. The B-57B unit cost was \$806,196, with a profit allowance of \$64,458.

It was developed that North American's stock received from \$25 a share in 1952 to approximately \$60 a share today, during the period of over 90% Government business.

Atwood reported that North Ameri-

North American Aviation

GOVERNMENT OWNED PROPERTY \$5,213,941
PRIVATE PROPERTY \$1,213,941

	Government Sales	Profit After Sales	Net Worth	Renegotiable to Other Major Civil \$100,000
1948	\$11,500,000	\$1,500,000	\$12,000,000	\$100,000
1949	\$11,500,000	\$1,500,000	\$12,000,000	\$100,000
1950	\$11,500,000	\$1,500,000	\$12,000,000	\$100,000
1951	\$11,500,000	\$1,500,000	\$12,000,000	\$100,000
1952	\$11,500,000	\$1,500,000	\$12,000,000	\$100,000

* This does not include stock paid at Boeing, Calif., on which distribution has not yet been made.

The Martin Co.

GOVERNMENT OWNED PROPERTY \$4,213,941
PRIVATE PROPERTY \$1,213,941

	Government Sales	Profit After Sales	Net Worth	Renegotiable to Other Major Civil \$100,000
1948	\$11,500,000	\$1,500,000	\$12,000,000	\$100,000
1949	\$11,500,000	\$1,500,000	\$12,000,000	\$100,000
1950	\$11,500,000	\$1,500,000	\$12,000,000	\$100,000
1951	\$11,500,000	\$1,500,000	\$12,000,000	\$100,000
1952	\$11,500,000	\$1,500,000	\$12,000,000	\$100,000

* Because of prior year losses Martin sold no shares from 1950 and 1951 and only \$1 million in 1952.

now has spent \$40 million for capital additions over the past five years and will spend \$26.6 million this year.

"Merely being in the aircraft manufacturing business does not guarantee that you will be successful, either technically or financially, regardless of the award of contracts by the Air Force, the Navy or any other Government procurement agency," Atwood said. "You have to be capable of handling a large, efficient and dedicated organization to achieve what has been accomplished by North American and others in the industry. Yet, for all of that, not all of every dollar paid to North American for the close of World War II, only a little more than three cents is compensation for work done by way of profit" (He added).

"If we continue to regard our policies and procedures relating to the development and maintenance of our military strength as something temporary in duration, we are making a road which can lead to very serious consequences."

"The industrial capabilities of our country must at times be able to sustain a defense establishment that will guarantee the preservation of peace or the successful prosecution of war. The defense industry has become a vital part of our national strength."

Boeing's controller Charles Stuen pointed Reciprocity Board decision requiring a \$10 million refund as excessive profits on the company's 1952 business, and declared that the "controlling factor" in the decision was not worth Boeing's profits were 32.5% of net worth before taxes and 27.7% of net worth after taxes.

Stuen mentioned that net worth "is not a reliable index of the reasonableness of a contractor's profits and therefore it should have no place in the recoupment process."

He pointed out that Boeing, since 1945, has already expended \$42.3 million on plant and equipment, and plans to expend an additional \$73.5 million through 1955.

At the Pentagon it was learned that the new regulation (AFR 90 20) was enforced for the first time early this month at an inspection of the Lockheed F-104. Fewer than 40 personnel took part and unannounced persons were barred.

"Boeing believes its earnings in 1952 were reasonable under any and all concepts of recoupment," Stuen said. "When a company has made a substantial contribution to the defense effort... and its profits are within the contractually established profit framework, a determination of excessive profits is patently unjustified."

"If allowed to stand, with a determination as well go forward removing the clearest of incentive which is so important to progress in research, development and production efficiency."

Industry Complaints Bring Limits On Visits by Inspection Boards

Washington—U. S. Air Force has taken two steps to eliminate growing aircraft industry dissatisfaction with the freedom of plant visits from inspection and contract technical compliance boards.

• Size of the boards has been increased slightly to insure adequate representation by interested commands.

• USAF has issued a new rule against unannounced "strollers" going along on board visits. No board will be allowed to exceed a maximum of about 50 men.

Action followed industry complaints that the numbers of plant visitors for a board inspection has been increasing to the point where it was in 300 USAF officers and civilians could take part in the study of an important new weapon.

The new rules provide that no workshop boards for other than Army aircraft, one member each is authorized for the Director of Requirements and Director of Research and Development of the office of the Deputy Chief of Staff for Development, for DCS, Materiel and DCS, Operations, the Air Materiel Command, the Air Research and Development Command, the Air Training Command, except when it is a young command. Each member has one vote.

There will be one non-voting member from the office of the Inspector General Major air commands or wing.

visitors scheduled to stock a weapons will be allowed at least one voting member.

When the Army is scheduled to use the aircraft, it will be allowed to have one voting member.

Contract technical compliance inspection boards for other than Army aircraft will consist of three voting members, one each from AMC, ARDC and one officer of the Director of Requirements, DCS for Development.

When a board is convened for inspection of technical compliance studies of an Army aircraft there will be six voting members representing the Director of Requirements, DCS Development, AMC, ARDC, the Army's Chief of Staff, Chief of Transportation and Continental Area Command. There will be one non-voting member from the Technical Air Command.

In addition to the board members, the new regulation authorizes advisors. Three to the board board are three from USAF headquarters, eight from AMC, 12 from ARDC and five from each major group concerned or service.

At the Pentagon it was learned that the new regulation (AFR 90 20) was enforced for the first time early this month at an inspection of the Lockheed F-104. Fewer than 40 personnel took part and unannounced persons were barred.

New Missile Split

Washington—Chrysler Corporation's assignment for weapon system responsibility for the post Army Navy reconnaissance wings (3100 miles) ballistic missile, puts the firm squarely in the middle of a growing split between the two services over that project.

Chrysler, which has been the prime contractor on the Army Redstone missile, is expected to develop an intermediate range missile suitable for both Army use on land and Navy use aboard ships at sea. The project part IRBM program represents a compromise between the divergent requirements for land and sea operations.

In the meantime the Navy Bureau of Ordnance is pushing hard for development of a solid-fuel IRBM with a schedule nearly comparable because of shipboard logistic and guidance problems. Army's Redstone Airland group is pushing for a liquid-fuel rocket embodying a long, thin design because logistics and guidance problems involved in handling launchings are less acute than in handling those in relatively short and moving platform at sea.

Pentagon feeling is that the IRBM program which now includes the USAF sponsored Douglas Aircraft project and the Chrysler IRBM program in addition to the post Army Navy projects—will now expand to four active projects, with the Army and Navy going their separate ways. The current compromise IRBM is expected to cooperate with Chrysler taking over the Army Redstone concept of a long, thin liquid-fuel rocket.

One of the biggest hotbeds in the expanding IRBM program is presentism, where North American Aviation Inc. and Aerojet divisions of General Tire and Rubber Co. are the sole sources of the type of liquid-fuel rocket engine now being designed into the three IRBM projects and the two USAF-sponsored intermediate-range missile projects. Redstone is developing a North American type rocket engine for the British IRBM program under license from the Colville firm.



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BOHME ET AL. / Stimulus Test Battery (Liberty and Liberty) with instrument calibration

Boeing's 707 jet transport prototype continues to accumulate flight test hours at a rapid rate. Since the 707's last flight July 15, 1954, the plane, in some more flight test periods, has made more than 250 test flights totaling more than 360 flight hours to test systems components and performance capabilities in actual flight.

The cloth image proved not very different, however. Eight light arrays with the pictures on the end and the following page illustrate Thomas's preparation for the cloth light phase, which is designed to check the distances and strains imposed on the complete airplane structure under all light conditions. Since data 72 strain gages were installed throughout the wing area to record stresses and strains, and extensive static tests were made to calibrate the gages with recording instruments for correlation with the readings that will be obtained in actual flight tests.

The plane will carry more than two tons of recording instrumentation and associated equipment during this phase. This includes heliostatic equipment, radiographs which will gather information from instrumentation on the aerodynamic surfaces, control columns, landing gear and accelerometers mounted in the wing tips and vertical fin, photo-



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INSTRUMENT engineers set balance controls before bending wing in subsonic test

wonder panel to film cockpit instruments, temperature recorder to take data on engine, fuel, oil, hydraulic fluid and outside air temperature, tape recorder to measure structural vibration, and a graphic recorder tape into the windtunnel for an engineering observer.

The plane is equipped for operating 150 data recording channels, with an additional 100 available if needed.

In the propeller static load phase, the 707 was suspended in a flight attitude in the structural test rig (the same as used in B-57 Superfortress static test) by a single-point support attached to the plane's keel beam. This provided unrestricted lateral and longitudinal movement, as though in actual flight. The landing gear was down and clearing the floor by a few inches.

Positive loads on the wing were bent to about one-third design load. In the flight tests, the airplane will be tested to 33% of design load.

A number of modifications have been made in the 707 as a result of experience in static and subsonic pressure in earlier flight tests. Top photo (above)

shows redesigned solid side-load link on the main landing gear. The original gear failed during two tests in 1954 (AVN Jan. 27, 1954, p. 13). For the new flight phase, slight modifications have been made in the flap, and the outboard integral wing reserve fuel tanks will be filled, bringing the craft's gross weight to nearly 250,000 lb.

An airspeed and glide slope antenna, as the being installed for test purposes, and other structural material is being changed around as part of continuing more level service in the plane. Other changes include installation of an airspeed and glide slope antenna, as well.

Navy Orders More Lockheed WV-2s

Boeing-Lockheed Aircraft Corp. last week announced receipt of a \$50-million U. S. Navy order for WV-2 early warning radar planes.

While exact quantities were not disclosed, Lockheed and the new order will extend production of the aircraft through December 1957.

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Holliston Field, Oklahoma
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OREGON

Medford Grant Field, Oregon
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PENNSYLVANIA

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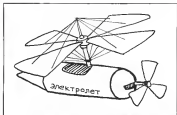
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LOMONOSOV'S Aerodynaemic of 1754 (Fig. 1)



LADYGIN'S electrophel, designed in 1909, was to be electrically powered (Fig. 2).

Russia's Rapid Helicopter-Design Progress

By Eugene K. Litvinenko*

The recent and rapid progress in Russian helicopter design, paralleling first country's speed development work for heavy jet bombers and supersonic fighters, has served to focus intense interest on the rotary wing phase of Soviet aviation.

Details of the early rotor-bladed helicopter have been publicly demonstrated at Tushino in unisolated field maneuvers, cooperating with units of the Red Army. Also at Tushino, large numbers of helicopter engineers, under the direction, showed both military and civil applications for flying in pairs

series, followed by aerial delivery of a light Podvoda car.

In the Soviet Helicopter-Engineering in design the Sikorsky S-35 was being used for design and construction.

Some Western observers have been shocked by what they consider the unduly high of Soviet helicopter fall short from the Red accumulated work.

What they forget is that Russia-like many other nations has a background of rotary wing development that extends back to centuries.

The little-known aspect of Russian aeronautical development presents a fascinating insight into the current position of Red aviation.

Michael V. Lomonosov, father of

Russian science, physicist, chemist, astronomer, geologist and geographer, was the first to make studies of lifting screws for vertical flight. Lomonosov, who in 1749 had born the first Russian elected to the Russian Academy of Sciences, presented his ideas on vertical flight in that body in 1754.

He showed details of a device for lifting themselves and other scientific instruments into the air, and submitted a drawing of the apparatus (Fig. 3).

The proceedings of the Academy and, in 1754.

The Honorable Academy Lomonosov demonstrated his invention called "AERODYNAMIC" to be used for the purpose of depressing the air in order of wings, isolated horizontally in the



ROTOR TESTS by Rikhsiev (Fig. 5)



VELOCOPTER by Bylin (Fig. 6)



HELICOPTER by Yevlev (Fig. 7)

Based on Two Centuries of Experience

opposite directions in the agency of a spring of the type used in clocks in order to lift the machine into the upper layers of the air.

The apparatus was suspended from a string and when the spring was wound the device rose in the air. On this event Russian trials show results in rotary wing experimentation.

For more than a century, Lomonosov's work was the only reference which in time, and in Russia.

But in 1898, A. N. Ladygin presented his design for a helicopter project to the Central Engineering Agency, the chief of his apparatus, ELICHOPTER. The design resembled a long cylinder with a cone at one end and a horizontal in the other (Fig. 2). The helicopter carried a propeller and control. The machine was supported by a lifting rod. To power the propeller Ladygin proposed an electric motor electric motor delivering 500 hp, driving the screws by means of a ground transmission. The Electrophel weighed 500 pounds (1,630 lb). Energy for the motor was to come from storage batteries which he failed to describe.

After consideration of Ladygin's project, one of the members of the Agency commented:

"Attempts to control an aircraft by means of propellers, rods, and wings, in the manner of windmills have been made repeatedly and have led to no useful results for this purpose."

He concluded that the project was "entirely unfeasible in practice."

In 1876, Ladygin left Russia to



ANTHONY PATENT for co-axial rotor helicopter was granted for design work that began in 1905. Coax was built and tested with poor results (Fig. 8).



YERKH helicopter (above) was ground-tested in 1952 (Fig. 9). Anthony co-axial (right) was completed in 1905 (Fig. 7).



Coaxial machine, B. N. Anthony, designed and built in California.



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further his designs, and worked on his proposal for many years. A few months after the start of World War I in 1914, he petitioned the Russian government for a \$5000 rights subsidy to enable him to produce a machine. At this time, his original proposal had been transformed into a craft capable of carrying one person. The proposal included four paddle wheels. Each paddle wheel was driven by a separate motor. The motors were supported by means of generators driven by a 30 hp engine. The craft had no rudder or elevator. Control was obtained by varying the power distribution to the paddles. A solution, however, consisted of a narrow error, which, unfortunately, turned the correct to the point if the craft was disturbed by a gust.

Ladysyn found a supporter in Professor N. L. Kirpichev, who concluded:

There is no logical basis for assuming that his apparatus will not be capable of flying."

On November 12, 1914 an Army Technical Board, sent hospital for a new weapon and not armament to visit, three weeks out reached the following conclusion:

"If successfully realized a flying apparatus of the type proposed by the described engineer, Ladysyn, could be of certain use to the cause of military aviation."

"2. Mr. Ladysyn's theoretical calculations and general calculations referring to his apparatus contain no inaccuracies or errors."

The Army failed to provide funds and the course of the War prevented him from advancing his project. Prior to the Russian Revolution he emigrated to the U. S., where he died in 1971.

Analysis and Design

In 1973, M. A. Sokolov, a member of the Academy of Sciences and Director of the Central Physical Laboratory, conducted experiments on air screws to determine their efficiency (Fig. 3).

In 1988, the scientist E. S. Fokas published a paper in the Proceedings of the Russian Technological Society. It presented a mathematical analysis of the possibilities of using air screws in flying machines.

An actual helicopter was proposed in 1997 by E. B. Iken (Fig. 4). The craft was a monocoque supported and propelled by means of a helical strip. Power was to be obtained by pushing the strip. His proposal was presented to the Russian Division of the Technological Committee but was rejected.

In September, 1989, N. A. Mironov, chief designer of an aircraft from the Moscow district, made public his design

Eugene K. Liberatore

This definitive article, prepared by Eugene K. Liberatore, Assistant Director of Engineering for Thomas Aircraft Corp., presents for the first time a complete history of two centuries of Russian winged aircraft.

Most of the material upon which this article is based was obtained from Russian sources. This work is to be presented in a definitive form as forthcoming publications of the Office of Technical Services of the Department of Commerce. These publications, comprising an *Illustrated series of early winged land boats* covering the complete art, were edited by the writer for Wright Air Development Center, Air Research and Development Command.

for an "Aviation Bicycle." The device consisted of two screws driven by the operator's feet. The inventor claimed to succeed in lifting the machine into motion (25 inches) and flying a distance of about 5 meters (15 feet).

He offered his invention to the Ministry of War and pointed out that the apparatus "can be of great use in military actions, as it will be possible to remove, rounded quickly, without making any noise." The proposal failed. As I have not been taught drafting and drawing, it was very difficult for me to think, let alone to make it from wood, especially with my hand tools. Therefore, much of it is clumsy.

The learned gentlemen can make it intelligently with elegant of metal, wire, canvas, and rubber tubing, but which can change the principles and laws of action, for I practiced much with the tailless bicycle. One wheel was made one eighth of an inch, in place of the other and given, made into a drum and beat the paddle wheels were made of sticks and covered with linen cloth 15 inches in length, 15 inches in width, practicing on it with all its weight resting on it. It separated from the ground, it lifted with difficulty and no more than 1.5 meters, then it no longer moved forward. I was working with my feet stronger, it was lighter I beat down on both. To my chief forward and it moved forward. From this I understood that working with my feet it was required bending down forward with my body. It was forward although I did not see high and did not sit straight, still I was in the air. I was in the air, and was in the air, that it can lift into the air, it descended but in this a parallel one, that having even even half an inch into the air it turned me true though

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steadily in the opposite direction of the wing so that, no matter what I start doing, it turned on with my side and back, from then my head turned. Then, I thought up attaching a tail to it but this did no good, then thought up making two additional paddles which follow the propeller wheels, they quenched it completely, a long time I struggled with them, so that this might be easily used, lowered, turned as a definite direction, then I thought up using bars, with which a one-motion wing lever it is easy to lift a 10 pound (45 pound) wing but the same wing there are difficult to operate fast, if they are attached, the wings cannot be properly directed, then I thought up springs, but, no matter how hard I tried, no springs can be made of wood the lower spring I made somehow, but the upper I could not make made it of rubber.

Although I never ran up into the air higher than one spoke, nor flew forward more than five inches, still I was convinced of the full practicability.

Therefore, if my ideas are lost, it will be only an error the learned gentlemen pay no attention to my model.

"The second vertical wheel is not needed at all. I attached it to rub the overhead wheel into more security, still it did no good, it is impossible to fix a wooden thing so exactly. If three vertical wheels are placed in a row in such a manner that the propeller wings of the middle wheels are higher than those of the side wheels, then in operating the compressed air flow under the side wings of the mid-

dle bicycle will move, with thrust, from under the wings of the center."

Twentieth Century Work

The new century introduced a number of rotor-wing developments that were completely in accord with those modifications in other countries.

In the general field of aeronautical engineering, Russia was a progressive nation. Efforts in aerodynamic research and internal configurations were equal, if not superior, to the other European nations. But in aircraft production, Russia copied engines were copies of French, British or American design. There were a few outstanding native designers, the most noted being Igor Sikorsky.

In the early years of the twentieth century, the leading aeronautical engineer was Nikolai Zhukovskiy. He came to be known as the father of Russian aviation, but he was also clanked by Poland, under the name of Janowski. He is known by the latter name in the U. S., especially for his work on the analytical approach to developing aircraft sections.

In 1899, Zhukovskiy had set up in Russia the first aerodynamic laboratory as part of Moscow University. In 1907 he added a wind tunnel to the laboratory.

On January 22, 1934, he released a communication "On the Useful Load Lifted by a Helicopter" analyzing the most attempts to solve the problem of lift and analyzing helicopter Zhukovskiy wrote, "On the basis of all that has gone before, it must be concluded that, given the present poor performance weight of the engine, a bi-

propeller helicopter cannot lift into the air more than a definite useful load, in countries making propeller helicopters, it is clear that with an increasing number of propellers, they can lift an load. Moreover, multi-propeller helicopters designed for the same propeller engine weight and the same useful load, give lighter weight aircraft with less powerful engines than do non-propeller helicopters."

In 1930, Zhukovskiy got a series of lectures on the "Theoretical Elements of Aviation" at the Moscow Technical Institute. In 1934 a special class in aerodynamics was organized, and some of his students later became leaders in the field of rotor-wing aircraft. Three of them were G. K. Sabinin, V. P. Votchkovskiy and B. N. Yuriev.

Little is known of the helicopter work of Sabinin, but Votchkovskiy prepared a coefficient in 1935 for evaluation of a rotor in hovering. He called his coefficient C_{H0} and expressed it as:

$$C_{H0} = \frac{T}{\rho \pi R^2 V}$$

The form of the coefficient is now used in the United States in the Figure of Merit.

Yuriev: 47 Years' Work

Of the three early students, Boris N. Yuriev came to be best known. His association with helicopter development has lasted through the Soviet and Soviet regimes. Today, he is looked upon as the patriarch of Soviet helicopter engineering.

Yuriev's helicopter activities began in 1909. In that year, he proposed a

small rotor helicopter design. In the central part of the fuselage was located a 75 H.P. Gnome rotary engine, which drove two ten-bladed rotors of different sizes. The upper rotor was 25 ft. in diameter, and the lower one 9.65 feet. The machine incorporated a variable pitch "storing propeller" for directional control. Which was provided for a steering tail rotor. There were provisions for a gas turbine in case the engine failed. The weight of the machine was 594 pounds. Later in 1909 a second version was designed. Yuriev estimated 50 H.P. was required to take off. The intractability, both of power plants of this size precluded the possibility of building a machine with a 25-80 H.P. Gnome engine, which was available at the Moscow Aviation Club, and he designed a modern-looking helicopter around this power plant (Fig. 6). It consisted of a single two-bladed lifting rotor and a tail rotor. The power plant was installed with its shaft vertical and slightly forward of the main rotor shaft. The drawing shows a power plant much larger than the one contemplated for use. The tail rotor was provided by means of a belt-drive system.

First Tail Rotor

In 1910, Yuriev applied for a patent on his device. A glorification of Soviet helicopter accomplishments in Soviet magazine written by Yuriev, under a Patent Certificate No. 45712, granted him in 1910. But Russian patents of that era had lower numbers, less than 70,000. Foreword he cites a patent application number. It checked in the New York Public Library's patents from Russia indicates that the patent was never granted. What is more significant, however, is the fact that Yuriev appears to be the first to develop the modern configuration of a tail-rotor helicopter (Fig. 6).

In 1910 Emil Berliner in the U. S. prepared a "GYROSCOPE" which incorporated a single lifting rotor with an antitorque tail rotor. There was

Illustration Only

The corporation chart appearing with Robert Moore's article, "Operations Knowledge: Basic Safe Design," (AW Jan. 16, p. 41) was prepared by American Work for purposes of illustration. It was intended to show only one possible corporation scheme suggested by the ideas in Moore's article.

In Dr. Caspary's plan for reorganizing such (AW Jan. 16, p. 65), the word "retained" should replace the word "person" in the sentence, "Corporate members in the prime position can be tolerated up to 2000" (p. 71).

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A Royal Canadian Navy Sikorsky HO4S (shown at collection trials at Canada's east coast. The trials are being overhauled to help determine the helicopter's role in the Canadian Navy's sub-hunter defense force.



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turned in the tail rotor by varying its diameter.

He was abandoned this for the co-axial configuration. As a result of his studies, Verney presented in 1911 a paper—*The Monocoque Uchiel Road Lined by Argonauts and Helicopters with Engines of Great Power*.

With the support of the Legion des Sciences, Verney constructed a prototype in 1912 designed around the Argonaut engine. Figure 6 is an early photograph of the machine. The rotor diameter was 76.7 feet. He had devised a pitch-change mechanism, but in order to save weight it was not incorporated in the prototype.

It appears Verney understood the principle of autorotation applicable to helicopters far prior to his death. He wrote, "The student aeronauts recognized that the blades of a large rotor revolving in air with the motor still serve as a fully reliable parachute and can thus be used to land at an angle to the horizon. This was the discovery of the phenomenon of rotor gliding."

The prototype, an overpowered, weighed 445 pounds. However the forward component for the pilot is not shown in this photograph. The model was displayed at the International Aeronautical and Automobile Exposition in Monaco in 1912. At that time, he distributed a pamphlet, *"A Short Description of the Verney Helicopter"*. For his helicopter design, Verney was awarded an Exposition gold medal.

The machine was ground tested and in the course of tests, the main rotor

drive shaft failed. Lack of funds forced Verney to discontinue the program and the onset of the First World War and the Russian Revolution prevented further development.

Verney later resumed his position as a leader in helicopter development under Soviet rule.

Two for Sikorsky

While residing in Russia, Igor Sikorsky produced two coaxial rotor helicopters.

The first machine was built in 1926 when Sikorsky was a student at Kiev Polytechnic Institute. This helicopter included two two-blade rotors and was powered by a 12 H.P. Dechard Argonaut engine. The upper rotor was 15 feet in diameter, and the lower one was 16.5 feet. The rotors turned about 160 r.p.m. Tests showed that the engine lacked sufficient power to lift the machine.

In 1910, a second helicopter was built. This machine was powered by a 25 H.P. Argonaut. Each rotor was 19 feet in diameter and had three blades. The empty weight was about 400 lbs. This unit could hover in one weight but could not turn the spirals.

After the helicopter trials, Sikorsky turned to fixed wing aircraft, and produced a series of successful airplanes in Russia.

There was other early coaxial helicopter projects and proposals in Russia in the field of a naval engineer, Dmitri Rukhlovich, who was a leader. Contemporary notes Glushko and



Britannia Flight Deck

Flight and re-flight profiles in the British Britannia helicopter transport show the relatively restricted look of the layout. Flight instruments are clustered in both glances. Normal crew complement is four, and a fifth position can be provided by a seat fixed behind the central console and between the pilot's positions. The Britannia is due to enter service with British Overseas Airways Corp. the summer on the route between London and Johannesburg, South Africa.

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Astronaut, who were more or less set on with helicopter projects.

The work of Rotodenskiy is quite worthy because it is precisely the earliest record of wind tunnel tests of a lifting screw under the influence of a horizontal wind. These tests were conducted at the Kuchino (Tashkent) Aerodynamic Institute near Moscow. The test used a 6.5 ft diameter screw was subjected to a wind of 20 fps at eight angles to the axis. The resulting thrust was two and a half times that of a screw without cross flow. This work was published in the 1999 edition of the Bulletin of the Aerodynamic Institute. Subsequently Rukolishchikov emigrated to France and in recent years has been involved in work on jet propulsion systems.

In 1958 Gerasimov submitted a proposal for a helicopter to the Army. The design featured a device for remote disk pitch control. The proposal was rejected.

Kamenskii A. Astronaut had been engaged in scientific development until 1957 when he turned to the problem of the helicopter. In June 1959, he undertook a program to produce a control rotor helicopter. The craft was built at the Leningrad Works in St. Petersburg and completed in January 1960 (Fig. 7). Later, Russian patent 21,172 was granted him on the device (Fig. 8). A tractor screw was installed for propulsion and two centrifugal rotors were used. The blades consisted of rectangular pieces of aluminum with one point at the hub. Each blade had pivot points at the hub and tip where it was attached in a large ring. This permitted the blades to change pitch. By lowering the pitch of the blades a disk rose forward which was intended to safely lower the craft in case of power failure. The prototype was fitted with a 51 H.P. engine. The rotors were driven through a gear transmission system. Astronaut conducted lifting tests with the new machine but with poor results. Concerned of the failure of further research, the rotors destroyed it.

(This is the first of two sketches by An. Astronaut on the program of Russian helicopter design. "New work" article will describe research and development from the Communist revolution to the present.)

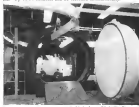
Ryan Receives \$4 Million In New Firebreed Orders

San Diego—The Ryan Aeronautical Co. has received more than \$4 million in new Air Force and Navy contracts for an undetermined number of jet-powered Firebreed models.

The new orders extend production schedules to late 1975 and President T. Charles Ryan said there are indications that the company will receive more Firebreed orders in the result of current negotiations.



GAS TURBINE ENGINE as put in Affinchuck cardboard container (left). Up to 35 models can be tested simultaneously.



GIANT ALTITUDE CHAMBER is 12 ft. long, 18 ft. in diameter. Tanks sitting next to it just been scheduled for test.



SMALL GAS TURBINES of the assembly line await tests. The new laboratory's main job at present is production testing.



DIVIDED ALTITUDE TANKS simultaneously provide solid conditions on one side without conditions on the other.

Lab to Test A-Plane Auxiliary Units

Phoenix, Ariz.—A big new 54-million test laboratory which will be used to prove auxiliary power units for aircraft-powered aircraft has been put into operation here by Affinchuck Mfg. Co. of Arizona a division of the Garrett Corp. The company, which has three contract-air Air Force, and one Navy to develop such units.

The Navy contract is for a 2,000-hp unit now in the design stage. Astronaut, which has learned The Air Force equipment would have lower ratings.

The largest auxiliary power unit now under development at Affinchuck is a 1,000-hp, medium for the Douglas YC-112 transport. The company with the largest unit now in production at

the company is 300-hp configuration. At present the laboratory is operating as a production test facility, said Rotodenskiy for auxiliary power gas turbines, air turbines, air turbine starters, pneumatic controls, color pressure regulators, fuel and cold air valves, refrigeration turbines, and heat transfer systems, as well as complete systems using these components. However, the facility will not be limited to testing production articles only. Among the major modifications in the test laboratory:

- A large chamber for altitude and cold and hot tests. It measures 15 ft. in diameter and is 12 ft. long. Altitude up to 75,000 ft. can be simulated at temperatures from -65 to 500° F. Air

flow rates up to 350 lb. per minute are available.

- Six cubic altitude tanks, each measuring 9 ft. in diameter and 15 ft. long. They are divided in the middle to create cubic conditions on one side, and ambient air conditions on the other side. Air flows up to 250 lb. per minute are available. The tanks are used for testing cubic pressure regulators and vaporizers.

- Four section cells, instrumented to test gas turbine, controls and heat transfer equipment.
- Three cells fitted to test fuel supply patterns, flow quantities and related characteristics.
- Fourteen valve test sections, with compressed air supplied at 250 to 1,500

OMAR

breaking through problems of supersonic propulsion

Engineers in training... Experienced engineers...

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Propellants and Fuels
Testing and Evaluation**

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- aerodynamic engineers
- stress analysts
- systems engineers
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- nuclear engineers
- radiation engineers
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On the OMAR team, you're affiliated with groups as in the field of supersonic propulsion: Reaction Motors, Inc., first in the American rocket industry; Montgomery Aircraft Company, the West's largest jet engine and aircraft engine repair and test company; Ohio Methusene Chemical Corporation, a leading producer of chemicals, metals, explosives and high energy fuels. You're on a team that counts for the first time both chemical and mechanical experience in research, development, and production of supersonic rockets, engines, and liquid and solid propellants.

For further information write OMAR Employment Office at the company nearest you:

- Ohio Methusene Chemical Corporation
440 Park Avenue, New York 22, N.Y.
- Reaction Motors, Inc.
Owens-Ill. Bldg.
Warren, Mich. 48090
- Montgomery Aircraft Company
13334 Emory Road
Van Nuys, California

jet engines up to 10,000, and flow rates from 15 to 250 lb. per minute. Test cells can be set for subsonic, supersonic or jet engine up to 10,000 ft.

Twelve pneumatic control test stands exist in place controls for valve control.

All the laboratory's test equipment is designed and manufactured in an in-house production area, which includes a machine shop.

Titanium Knowledge Lags Behind Need

Technical knowledge of titanium lags behind industry demand for the metal and its alloys was the conclusion of a symposium attended by representatives of five major titanium suppliers at the Des Moines, Ia., plant of Sola Metals Co.

The symposium dealt with fabrication and other problems confronting titanium, some alloys of which have been in full production for two years.

Symposium discussion covered three points:

- Road strength and formability of titanium alloys are not yet uniform and will vary from sheet to sheet. Suppliers will be working on rolling of high strength alloys, sheets that will vary less than 1 to 2% from true thickness.
- Technical standards for analysis of titanium and its alloys have not yet been established and are needed to speed progress.
- Supplies of several alloys and types

of titanium alloys is obtained in capacity as needed.

• Titanium products are working on development of specialized alloys for bagging, sheet metal fabrication and other requirements.

• Supplies of titanium are still on a learning curve.

Sola is producing an alloy jet as available and aims dual parts from titanium, and has sales aggregating several million dollars for titanium fabrication.

Suppliers represented were Reaction Motors, Inc., Republic Steel Corp., Titanium Metals Corp., Shuman Steel Corp. and Midway Station Titanium Corp.

Boeing Announces Expansion Program

Boeing Aircraft Co. has announced plans to build a new \$21 million dual operational center at its main plant in Seattle and a \$8.5 million manufacturing and office facility at Renton, Wash.

The development center, which will add 1,821,000 sq. ft. of covered area to the Boeing operation, is scheduled for completion by the fall of 1957. Phases of the Boeing project, physical research, structural testing and experimental activities are among the four main areas which will occupy the new area.

The Renton facility will cover about 518,000 sq. ft. Major portion of the site will be used for assembly of both sections of Boeing's 707 jet transport. The offices of the facility will house the company's new Transport Division.



Photography at 45,000 ft.

New version of a McDonnell RF-101A, USAF's supersonic reconnaissance plane, took the above sharp 45,000 ft. high-altitude photo of the Missouri River near Washington, Mo.

JET ENGINES

Montgomery Aircraft Company
Van Nuys, California

PROPELLANTS

Ohio Methusene Chemical Corporation
New York, New York

ROCKETS

Reaction Motors, Inc.
Easton, New Jersey

WAR GUARD AIRCRAFT
OUR PARTNERSHIP ORGANIZATION
REACTION MOTORS

At Evendale plant, specialists learn . . .

HOW TO SERVICE G.E.'s NEWEST ENGINE —THE J79 TURBOJET

Experience on J47, J73 engines enables G-E training school to
ready technicians for advanced, high-performance powerplant



UP TO 16 WEEKS, INSTRUCTION on G-E jets is given to engineering and technical people who attend G-E factory engine school. After graduation, students will know how to work on military maintenance shops, at special test sites, or on G-E's assembly and over-haul lines. Training helps assure reliability of G-E J73 and J47 engines.



PROPER USE OF ENGINE TOOLS is taught at factory school. These above are used to assemble and disassemble G-E J73. Average of 215 special tools are needed to service jet engines.



FULL-SCALE ENGINE ASSEMBLY is learned through on-the-spot study of G-E turbojets. The G-E engine above is rated at 5000 lb thrust. It has been built up 13 times in past year. Students are installing turbine wheel.



FACTORY TEST METHODS are part of 16-week course, where each student puts in 35 hours at test cells. Instructions can set up engine problems for students' solution.

If you were to attend General Electric's factory engine school at Evendale, Ohio, this year, you would look forward to studying G-E's newest, most powerful turbojet—the J79.

Since 1953, over 7000 jet engine specialists have graduated from the school. They learned (1) maintenance and overhaul procedures for G-E J47's and J73's; (2) how to "trouble-shoot" these engines, and (3) how to construct others, if required.

Now—and all through 1956—courses on J79 installation and operation, as well as J79 accessory systems,

will be conducted, in addition to those on the J47 and J73. Besides 210 G-E field service engineers, many other personnel will attend from the Armed Services, aerospace companies, and the NACA.

The Evendale factory engine school is an excellent example of how G-E backs up its turbojets. For General Electric, while continuing to provide trained specialists for 35,000 engines now in the field, at the same time prepares for future service needs of newer engines. General Electric Company, Cincinnati 35, Ohio.

200

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HF440-5005 on Strohoff Pantobase (left) and single-engine C-123 hedgehog aircraft (right) as test plane.

C-123 Pantobase, Flow-Control Research

Strohoff Aircraft Corp., W. Tuscarora, N. J., is experimenting with two different versions designed to significantly improve the capability of the C-123 cargo aircraft.

Pantobase, right and lower left shows Strohoff's converted C-123 during test runs of its retractable landing gear. The Pantobase modification (AVR Aug. 1, p. 18) gives the aircraft the capability of operating from water and unimproved landing strips.

Pulse at lower right shows the company's C-123 fitted with boundary-layer control. The Strohoff system uses a Carburetor-built Ayres 2 ducted fan in the air pump. The boundary-layer control gives the aircraft a higher lift coefficient at slow speeds and improves its short takeoff performance.



AS AN AMFIREMAN, C-123 takes off on hydrofoils that slide down below wheels.



PANTOBASE C-123 (left) tests onto ramp at end of test run. At right, modified Strohoff C-123 tests boundary layer control system.



hungry "pups"



Like hungry pups, Dave Air Force jets at the same time made up to this big KB-50 Haynes-modified tanker for refueling. Unlike the pups, the three jets have been given by Haynes Aircraft engineers the advantage of simultaneously refueling in flight — thus saving precious time needed for a vital mission.

This 3-point "Probe and Drogue" tanker carries a fuel load of almost 25 tons and refuels 3 jets in a matter of minutes. To operate the pumps, it generates enough electricity to light approximately 300 homes. Its design called for solution of engineering problems in aerodynamics, aerophysics and electronics by Haynes Aircraft engineers.

HAYES ENTERS COMPETITIVE FIELD

Haynes Aircraft Corporation has been changed from a research facility, operating under a management contract, to an industrial facility. Under this concept, Haynes now enters the competitive field for engineering, design and manufacturing. A large multiple-buy plant, modern equipment, engineering know-how and skilled craftsmen give Haynes one of the most versatile and efficient aircraft modification facilities in the Nation.

ENGINEERS • DESIGNERS • MANUFACTURERS



EXCELLENT OPPORTUNITIES OPEN FOR ENGINEERS—SEE PAGE 68.

B-50 TANKERS MODIFIED FOR TAC BY HAYES REFUEL WITH PROBE AND DROGUE SYSTEM DEVELOPED BY FLIGHT REFUELING INC.

These reel units, nozzles and couplings developed and manufactured by Flight Refueling, Inc. are used in the new multi-point tanker program now being undertaken for the Tactical Air Command by Hayes Aircraft Corporation, Birmingham, Alabama. The Probe and Drogue system, pioneered by Flight Refueling, Inc., permits transfer of fuel at high rates of flow, at high speeds under all operating conditions. Its numerous features eliminate the need for trained operators, make possible multiple refueling operations. Flight Refueling, Inc., pioneer and leader in the field of aerial refueling development, is proud to supply the vital components for TAC's new tanker program.



These FLIGHT REFUELING Inc. components make up Probe and Drogue system



A 12E hose reel unit, mounted in tail and wing tips of B-50, automatically reel out hose, transfer fuel at rate of several hundred gallons per minute. Qualification test reports have been submitted to WADC.



MA-2 coupling, mounted in drogue, and MA-2 nozzle, mounted in probe of receiver, permit automatic fuel-right connection between tanker and receiver. Probe and Drogue system was pioneered by Flight Refueling, Inc.

ATTENTION ENGINEERS

Formulate, now projects to develop new long-range flight systems present unusual career opportunities for engineers for whom Wide Engineering Manager for further details.



*Flight
Refueling
Inc.*

FRIENDSHIP INTERNATIONAL AIRPORT
Baltimore 2, Maryland

1
2
3
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7



This unusual die-casting test stand at Hayes Aircraft Company, the K&H 623 (see Flight Refueling Inc. advertisement on previous page). The K&H 623 is a 623 (see Hayes Aircraft Company, 3811 Connecticut Avenue, Washington, D.C.)

8 Jack & Heintz Generators paralleled in unique d-c system! ... engineers achieve 78% more power for K8-50



The K&H 623 (see advertisement on previous page) is a 623 (see Hayes Aircraft Company, 3811 Connecticut Avenue, Washington, D.C.)

In converting the Boeing B-50 Superfortress into the K&H 623 engine in flight tank, a substantial power boost was needed to drive the array of rapid-response fuel pumps from scattered throughout the plane.

The approach lay in developing a new higher-rated generator on parallel line eight available 100 amp machines.

The Jack & Heintz G23 generator proved to be the answer. Based on a 623 generator, the high voltage characteristics in the K&H 623 this generator required only a specially modified housing and a modified mounting flange.

Through the use of the G23, Hayes and Jack & Heintz engineers have achieved a power supply of 1200 amps in the same available space, with a maximum of 1800 amps. The supercharged paralleling of eight generators has been tested previously completely reliable.

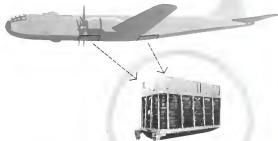
Also available is a modified G23 with an increased rating of 1500 amps, which is ideally suited to other applications.

For complete information, write Jack & Heintz, Inc., 1700 Broadway, Cleveland 1, Ohio. Patent Dept. P.O. Box 100, New York 10, N.Y.



Photo by Jack & Heintz, Inc.

JACK & HEINTZ *Rotomotive* **AIRCRAFT EQUIPMENT**



*"Drape shape"
fuel tank assemblies
lighten the load*

Each of the drape fuel tank assemblies for the KC-50 has a drape construction that gives it two side rails. Manufactured with 7075-T6 aluminum, 100% drupe weighing only 8.22 pounds per assembly.

FIRESTONE'S CONTRIBUTION TO THE KC-50 REFUELING TANKER

Exclusive drape construction of bladder cells in the Firestone tank assemblies in fore and aft bomb bays of the KC-50 reduces overall weight approximately 600 pounds as compared to metal tanks of the same capacity.

This service-proved drape construction—originated seven years ago by the Fuel Cell Division of Firestone—reduces weight by eliminating bucking material. It lowers initial cost. And it lowers installation cost, since assemblies may be placed in crates without providing 100% support. Flat loads between structural members are carried by the cell walls.

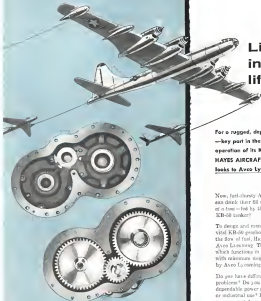
In addition to the KC-50, Firestone lightweight, drape-constructed fuel cells have been used successfully in the B-45, B-36, B-47 and B-50. More recently, they have been chosen for the KC-135 and F-104.

This engineering know-how is at your disposal.



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in a
life line**

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key part in the refueling
operation of its KC-50 "tanker"—
HAYES AIRCRAFT CORPORATION
looks to Avco Lycoming!**

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can drink their fill in mid-air—their
of a new link by the Hayes-coined
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Valve Tak

See WM. R. WHITTAKER CO., Ltd.

By Herwin Allen,
Senior Member, Aviation Writers Assn.



When three jet fighters made up simultaneously to a rear refueling hose trailing from a Hayes-modified KB-50 multi-point tanker, five specially-designed Whittaker valves stood ready to go to work for the trio of thirsty rappers.

Motor-operated gate types of three-inch tube size, the Whittaker units incorporated into the Hayes probe-and-droop system are all identical, each one serving as a shut-off valve near the pump for an individual fuel cell in the tanker's foreleg.

The valves handle pressures greater than that of the average low bypass, their slides controlling anywhere from a standard 120 pounds per square inch to a maximum 200 psi. They operate in one second—or less—to free the rushing JP-3 through the 100-foot seed lines or chop it off instantly and automatically when the fighters are through drinking.

The Whittaker units were designed and built specifically for the Hayes system which demands fast, definite and dependable action. They give precise pressure surge and at the same time provide thermal relief through special pressure valves that bleed off excess fuel that might be trapped and heat expanded.

An additional feature is a manual override a short lever arm that pins from the structure to meet aircraft idly with the slide in its open and closes the gate if no electrical power should prove automatic line draining of the valve. It can be opened quickly by hand.

Hayes Aircraft launched its probe and droop system in the late 1940s, Alhambra plant in 1951, first modifying a B-70 into a KB-50 to carry the tanking job. Today the multi-point system of lines, valves, booster pumps and control gear that directed fuel to four tanks in the tail section and the two wing attached pods.

But although the system worked perfectly, refueling three fighters simultaneously was found to be tedious and dangerous was too slow, so refueling modifications, to handle the four down per minute desirable, began of operation.

Recognizing the value of the Hayes development the Air Force gave the Alhambra company a contract to modify an unmodified tanker at Fairport Harbor, E-10, with the same system. It was then in process through last December when the prototype KB-50 made its maiden flight, and Whittaker was awarded a job of fitting out hundreds of shut-off valves in an integral part of the probe-and-droop operation.

The Hayes modification began the external expansion of the big, four-



NEW A-C POWER TRANSFORMER



First of J&H line...
batters Spec MIL-T-8219

Now in use on such leading aircraft as the Boeing B-47 and Consolidated General Electric and Boeing MD-3 powered power units, the Jack & Heintz GC100 was to-date power transformer has passed all qualification tests. Designed to MIL-T-8219, the transformer offers a higher percentage efficiency and lower regulation than required by the specification.

ENGINEERING DATA

Rating	1 Kva at 0.8 pf
Frequency	300-600 cps
Primary Voltage	200 volts ± 1
Secondary Voltage	11.7 volts ± 1
Overloaded (90% duty cycle)	100%
Regulation at Rated Load	4%
Power Factor	0.85 at 0.8 pf
One Minute Rating	2.5 times at 0.8 pf
Ambient Temperature	-40°C to +110°C
Altitude	20,000 ft. max.
Weight	0.7 lbs.

For complete design details and for information concerning the availability of power transformers in other ratings, write Jack & Heintz, Inc., 17631 Broadway, Cleveland 1, Ohio. Export Dept., 15 E. 40th St., New York 16, N. Y.

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JACK & HEINTZ
AIRCRAFT
EQUIPMENT

Hayes Aircraft produces AUTO-LITE 350 WIRE for use in Air Force KB-50 Tankers



Withstands **-80°F to +400°F** temperatures

Designed to meet exacting requirements of military aircraft, AUTO-LITE 350 General Purpose High Temperature Aircraft Wire has been specified by still another leading aircraft manufacturer Hayes Aircraft Company will use AUTO-LITE 350 Wire in one of the first major military orders for Probe and Droop refueling equipment... the KB-50 Tanker.

Aircraft manufacturers are finding AUTO-LITE 350 Wire reduces overall production costs compared with other high temperature wires. It was perfected for rugged duty... at sea level or at 80,000 feet... from liquid -80°F to liquid 400°F. It offers resistance to abrasive wear, flame, solvents, acids and alkalis. Write for full information on AUTO-LITE aviation wire, including specifications and samples of this superior product. APPROVED BY MIL-STD-200A 2/56

- Flexible at -70°F • Insulation • No deterioration at maximum operating cable temperatures • In normal installation, this wire is satisfactory at -80°F, or at an altitude of 80,000 ft. as measured at the equator • Resistant to modern aircraft hydraulic fluids, lubricants and fuels for both reciprocating and jet-type engines • Flame-retarded • Easy painting of circuits with conventional marking mediums • Free shipping • Meets Spec MIL-W-2777, U.S.A.F.

AUTO-LITE 350 GENERAL PURPOSE HIGH TEMPERATURE AIRCRAFT WIRE

THE ELECTRIC AUTO-LITE COMPANY
Pitt Haven, Michigan Rochester, Pennsylvania

Wire and Cable Division



Hayes Aircraft Corp.
Fairport Harbor, Ohio

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Chance Vought's new, carrier-based F6U-1 Corsair... the world's fastest Navy fighter... is distinguished by its high rate of climb, exceptional combat ceiling and maximum speeds.

Doing an important job on this high-performance jet is Bendix-Utica's new Type 28L11 air turbine driven AC-DC generator. It maintains the continuous power supply that cannot be achieved with conventional drive methods under extended periods of Zero G.

The 28L11 also brings many other package advantages, such as lighter weight and smaller size, complete de-

pendability through an extreme range of temperatures, and a self-contained control system.

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methods, and by controlling the automatic control of the machine tools employed by variable electronic means, the possibility is afforded of producing new off components, or batch quantities of items of a complicated nature in a simple way.

Automation Potential

The part to be manufactured will have to be described either numerically or mechanically and the microcomputer coded and fed into the device control of the machine tool.

These coded directions are interpreted in the form of electrical pulses, which control the servo motors operating the machine tool slides, thus bringing about the guidance of the tool piece, or the tool. Of late a great deal has been heard about automation, a word which is not yet in any dictionary but soon will be. The use of numerical or automatic control for machine tools which has just been described does not properly come under true automation.

For simple two-dimensional regulation of machine tool slides or for drilling by co-ordinated means, automatic control by the use of teleprinter type is possible.

Machine Construction

There are many approaches to the electronic control of machine tools, and it may well be that eventually standard lists of parts will be on the market of reasonable price, which will enable the construction of standard machine tools in order that they can accept punched tape type for automatic control.

Tooling will first make itself into the simplest of fixtures for the accurate location of the work and the position of a punched tape which has been produced on teleprinter punch machines or teleprinter from numerical data supplied in the Planning Office.

This approach will enable a large variety of two-dimensional cutting work, complicated progressive drilling to close limits, the production of turned parts and other machine shop operations to be carried out with a minimum of tooling, with increasing accuracy.

The introduction of this system will inevitably reduce the lead time in the manufacture of new prototype models and will very markedly meet an accelerating rate and time in full scale production.

It is therefore of the highest importance that this interesting new technique should be pushed on as extensively as possible, as it would seem to make it possible for us to excel in this type of construction, which fits in so well with our type of training and engineering background.

The distasteful factor, however, is the attitude of the machine tool manu-

UNIQUE SENSITIVE RELAY
incredibly small,
lightweight and
adjustable

ADVANCE "SO" SERIES

Here for the first time is a sensitive relay only 1-7/32" x 1-1/8" x 1-1/4"... weighing only 1-1/2 ounces, and adjustable over a wide range. You get much more latitude with this relay in designing for tiny sizes.

The Advance "SO" is set at the factory in operation on 30 millivolts. User can adjust it down to 2 millivolts, or any desired pickup or dropout, by means of fine screw contacts. A balanced armature provides extremely sensitive operation. The unit is highly efficient, ruggedly built, and offers excellent shock and vibration-resistance characteristics.

Contact arrangement is SPDT. Coil resistance: 4000, 6500 and 10,000 ohms. Life expectancy: 250,000 operations. Available in open type... one-eight or hermetically sealed enclosures. Now in quantity production. Advance "SO" relays are priced amazingly low. Write for literature.



Coil Resistance	Pick Up Voltage	Pick Up Current	Drop Out Voltage	Drop Out Current	Max. Coil Voltage for Continuous Duty	Dropout	Standard Drop
4000	6.4 V	3.6 MA	3.2 V	5 MA	110 V	.0015	.002/.003
6500	8.1 V	1.25 MA	3.9 V	6 MA	140 V	.0015	.002/.003
10,000	10 V	1 MA	5 V	5 MA	175 V	.0015	.002/.003



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Research for special reports has been under way for the past six months. The latest information on foreign aviation is pouring in through AVIATION WEEK's world-wide network. AVIATION WEEK editors are traveling on a tour bus throughout the industry seeking out the type of material that will make this edition a top issue of 1956. Volume of

aviation statistics are being pocketed into detailed specifications tables covering all U.S. and foreign aircraft, helicopters, engines and missiles.

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AVIATION WEEK

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42-1775

coming soon for aircraft engineering. I feel the shift and the speed of change there is an absolute ghost fear of the whole nation, to the importance of all branches of engineering, and particularly aircraft engineering, in the coming generations.

Let us be frank about this; it is still not "out of the top drawer" to be a mechanical engineer. The scholastic standards from our senior schools and universities have not come long from accepted standards, and now give far more to engineering as an accepted profession, but by and large, still do not believe it to be so in their hearts. In actual fact, it is freshmen engineers of high ability, many from the right background that this country needs.

I am astonished when I see working for Sir Stafford Cripps in the pre-barrister occupations in the setting up of the College of Aeronautics, and find to my amazement at the college, even in his infancy on this matter, how strength there, all traditions paralleled, can accept entry of the most common man in the Government at the time. I therefore, perhaps, in doubt, the sort of my criticism as obvious as an occasion to help defend these "bird in the nest" fallacies.

Mr. George Constantinescu defended a classic lecture on this subject before the Society of Engineers' in his lecture, and I propose to quote a few of his comments:

It is difficult to give comprehensive definitions to distinguish between the scientist and the engineer, both of these two words, each as defined as a noun.

"Early scientists like Plato and Aristotle had their own ideas, short notes and short observations which made them rather conspicuous through the mechanical arts."

What he called the mechanical arts after a certain stage and an insight he summed in two cities: "That man is good that by knowledge governs the elements of his life, with his life."

The old cleavage between pure science, as scientists like to call their domain, and the practical science which is confined in the domain of the crafts, exists in this life, only in a slightly modified form.

To argue that engineering is the product of applied science is not correct. Engineering is the product of knowledge of all kinds of skill, personal traits, organization, faith, service, friendship, even, brotherhood, and human help, and individually with a man against the scientist.

And why is it called the Science Mankind? Why not Engineering Mankind?

The Science of most of the scientists in the Science Museum is the faith of scientists who used their knowledge

and skill to illustrate and achieve something new in spite of the scientist and the scientist of their time.

"One fact that the scientist is to be found in the old ingenuity tradition that practical science is inferior to pure science, that people who work with their hands are inferior."

Lingering Doctrine

This is the doctrine that runs along at the time of Ptolemy, Plato and Aristotle. It is not so well to realize that this doctrine is not dead.

Scientists are not inferior to engineers. Scientists, engineers, practical scientists, and all, are not children of nature, leading them different places and in different circumstances at the same problems.

"This barrier between scientists and engineers could be lifted by training both of them at the same school. A school in which, at the University of Oxford, has introduced, however, into the training of engineers."

Twentieth scientists and engineers should merge into one single profession of man, with one single purpose to work together.

Commander G. P. Kinnaird recently published book, entitled "Up From Down Below," brings out excellently the long fight the naval engineer has had to come into his own. The long movement in the duties of the naval engineer has been comparatively slow.

It has taken about two hundred years since the Captain of H. M. S. Albion ordered "Chief Engineer, be brought when he had finished with his engine, to the time when it has been publicly stated that naval engineers are all first and foremost naval officers. Only during the last few months has the naval engineer shed the "chief" design, which has been with him for centuries.

His qualifications put the most prominent British war training school, from both in Britain, that he is taking a course of education, that was engineering, then naval, and last of all, that was naval engineering.

We can understand the many other industries that can lead and take, the necessary steps to provide adequate facilities in terms of the right type of capacity for the Science Government departments and industry, but one of the most important things to help in the production of our aircraft on a large scale is to eliminate this stigma on engineering as a profession.

What then is we going to do for the future in the next few years of the nation's aircraft? Sir William Churchill wrote in his report of the last War, that under such circumstances, the great thing to remember

was the overall objective. Are we really quite clear what this is as applied to our present problem? We certainly cannot afford to have things as they stand today—10 years after the War.

It seems to me, one main trouble has been that with a few notable exceptions, neither in the Government nor in the British aircraft industry has it been realized that the opportunities that would be available during those 10 years have been lost. The consequences of this and the bearing upon it to succeed at all costs.

This taking is such a disadvantage of when the country stands alone in many other respects, and it would seem that after a civilization of so long standing as ours, seen a major way, the tremendous effort that has been put into it is followed in an improvement of scientific and fresh energies. This results in a whole crop of well training but ill considered regulations coming into force, which are enforced and almost without discussion results.

We must take a stand to prevent this without adopting a strong and rigid industrial and scientific, and even in Government service and industry, including the strongest of our present law books, all due to some measure the great responsibility that exists, to contribute towards putting the matter right with the best possible dash.

Let us therefore go back to work from this Conference realizing that someone, however humble, can make very contributions, and that we must no longer accept excuses or words but must be determined to have done.

As I was writing these notes a few days ago I received a copy of Lord Havers' message to his naval people in which he said that he believed it is worth fighting hard to prevent his country's supremacy in the making navy. Knowing this, had the knowledge, the skill and the resources of this world project, I spent a good deal of my afternoon to help others to be confident for the future. This is the spirit which must meet it. It is not an easy task but British aviation is light here.

Some times industry are better situated in regard to leadership and trained civil engineers that are and large. I believe, the personal sciences are all available in this country to meet our needs in aircraft if only someone will courageously put this shoulder to the wheel and get it set up. So far, however, in our view we have hardly made the first move on the fundamental issues.

This is the fourth and last in a series of articles in which I have tried to report the speech in Sir Roy Fisher before that was taken in the House of Commons on the subject of the President of the Royal Society on the subject of the President of the Royal Society.

VOUGHT... FOR COMBAT SUPERIORITY



Bird from under the Sea

Regulus, U. S. Navy's First Operational Missile

Proven in the tough acceptance tests—the results of the tests established in flights from carrier, submarine and ground—Chrysler Vought's Regulus in 1955 became the U. S. Navy's first operational guided missile.

Helped this achievement by nearly a decade of intensive guided missile work and the years of Vought experience as innovation pioneer and leader.

Introduction of Regulus to

Regulus seems too delicate—designed to test and train, equipped with a nuclear life-saving gear.

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AVIONICS

New Device Boosts Computer Flexibility

A new device which generates a dependent variable signal as a function of two independent variables, making it extremely useful for analog computers, flight simulation and aircraft tracking, has been developed by the Stephen Douglas Co. under Wright Air Development Center sponsorship. Engineered mathematically, the device decouples a signal $Z = f(X, Y)$.

Called PHOSIAC (Photographically Stored Information, Analog Computer), the new apparatus permits rapid change of the functions generated. This is done by merely changing a small photo plate upon which the data is stored.

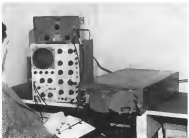
Function generation, widely used in flight simulation, are two-dimensional (function) devices, consisting of a series of three potentiometers, wired to duplicate the characteristics of one specific curve. If it is desired to simulate a bank of curves (two-dimensional), it is necessary to stack a number of such potentiometers, and provide a switching device to shift from one to another, Stephen-Douglas says. And, if it later becomes necessary to change the form of the equation described by the bank of curves, as the event of a change in base vehicle characteristics, the potentiometer bank must be replaced or rewired.

PHOSIAC can perform the desired mathematical function, without switching, with a frequency response of 100 cps. or higher, considerably beyond that obtainable with potentiometers, Stephen-Douglas says.

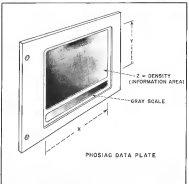
The data plate used in PHOSIAC is generated from a family of curves which describe the desired function. The data is first converted to punched tape, which in turn controls the exposure of various portions of a 35-mm film, which in turn is reduced to 1/100 in. to form the data plate.

The density (darkness or lightness) of the film at any position relative to its "X" and "Y" direction coordinates represents the value of the variable "Z" as a function of the two independent variables "X" and "Y" on the family of curves.

The data plate is inserted in PHOSIAC between a dual beam cathode ray tube and a photomultiplier tube. One beam of the CRT is positioned in an "X" and "Y" direction in two deflection voltages, each proportional to the desired value of the independent variables. The amount of light which passes from the CRT through the data



PHOSIAC ACCESSORY (right) for analog computers and flight simulation generates a signal as a function of two independent variable inputs. Key to PHOSIAC is the



DATA PLATE in which film darkness at any point, relative to horizontal and vertical scan, represents value of variable function. Bottom gray scale provides calibration



how North American Aviation solved a tough metal forming problem

The jet engine on North American Aviation's F-100D Super Sabre gulps up to 2200 cu. ft. of air each minute. To minimize the disturbance of this high speed air flow, the jet engine accessory cover must be of precise shape to conform with the efficiency of duct design. After evaluating bids from suppliers on the basis of reliability, delivery, performance and cost, North American Aviation chose Pastushin's bulge forming process for this exacting metal forming task.

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plate to the multiplier base which is proportional to the desired dependent variable. The multiplier tube generates a proportional output signal.

In composite for operations in CPU systems, it will also change in the density of the data plate caused by ion capture or other factors. Each data plate has a graduated "zero scale" along the bottom, which is etched in the same figures.

The second beam of the CRT forms

on this reference scale and serves to offset to calibrate the primary device measurement, canceling out the above error of error.

The device will accept input voltages (independent variables) of 0 to 50 v., and produce output voltages of 0 to 400 v. Accuracy is quoted at 7% of full scale in linear, and response time is 0.01 to 0.02 seconds.

Stephen Douglas Co.'s address, 2950 Nicholas Ave., Santa Monica, Calif.



MARCO'S NEW and small condenser VHF communications radio transmitter

Communications Set Cuts Weight by Half

A new small condenser VHF communication receiver-transmitter, with 7 lb. weight which is approximately half the size of comparable equipment now on the market, has been made available by National Aeronautics Corp. The new Model 1016, second member of Navco's defense "Supine" line, provides a VHF transmitter with a band of 90 to 160 channels and a VHF receiver with 90 to 160 channels, covering the 105 mc. to 115 mc. in 150 mc. band.

Navco reports that the new 1016, which weighs less than 7 lb. and comes in a 4 1/2 lb. case in the first set, is suitable to meet new, more rigorous requirements established by the Civil Aeronautics Administration.

The basic 1016 transmitter and receiver provide 90 channel capacity. However, by adding 19 more channels, the transmitter capacity can be increased to 109 or 160 channels by using up to 48 crystals.

When used for emergency operation, transmission and reception on the same frequency, a single channel selector in the cockpit instrument panel automatically transmits both the transmitter and receiver. If cross-band communication is desired (transmit and

receive on separate frequencies), separate frequency selectors can be mounted side by side.

The Supine 1016 is designed also to provide VOR and ILS functions. In addition, a lock-a-compare unit, now under development at Navco, is added. Like the Navco DME, the new 1016 has been designed with modular construction. The transmitter, receiver and power supply can be quickly removed for repair or replacement. Navco says. The firm also is marketing a loadboard interface for use with the set.

The Supine 1016 is priced at \$2,495 for the basic 90-channel unit or at \$2,800 for the set with 160 transmitter channels and 160 receiver channels. Navco's address is Anaheim, Florida.

Expansions, Changes In Avionics Industry

International Business Machines Corp. will establish data processing centers in Los Angeles, Calif., Portland, Ore., and Seattle, Wash., as part of a nationwide dollar expansion of its West Coast operations. The centers' facilities will be available to industries on a rental basis. The Los Angeles data processing center, to be located in a new 11-story, brick-and-stone building, is under construction and 1977, will be

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Ford's Night-riding Research Laboratory at Dearborn Park, Mich. counts a new test unit in daily electronic tests, and performance, 1-in. testing other, measure engine speeds, volume and apply what team operating.



Douglas test rig. Counters for time interval work, measure up time (up to 1000) second, as well as frequency measurement, as AC (audio) and generator and detecting frequency characteristics of test circuits.



Chrysler provides and gives them what before an expensive array of test devices. Its Counters design, construction and analysis performance of many parts with extreme accuracy, even being in-line measuring area intervals as small as 1/100,000 second.



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General Electric test rig. Counters in both development and production tests, systems. Typical uses include checking working motor performance and checking crystal frequencies for timing D.C. and microwave TV systems.



Esso Laboratories develops in Counters with Research Center use for Counters to report gasoline performance by quality, easily measuring engine speed in (up to 1000) rpm between spark and ignition, time required for maximum should after firing.



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These Counters are not delicate, expensive prima donna requiring a staff of PhD's to operate and maintain. About the size of a large table radio, they're rugged, dependable, job-provers, versatile, manufactured in quantity and priced from about \$900. Anyone who can count can use them—they require no charts or complex calculations. Yet their performance is perfection itself—direct-reading, instantaneous, automatically accurate within 1 part per 1,000,000.

Industry uses Electronic Counters to measure rpm and rps, weight, pressure, temperature, velocity, speed, acceleration, dipage, elapsed time or time intervals, frequency rates, production quantities. And, they have many other functions; Electronic Counters are only at the threshold of their usefulness to industry.

Hewlett-Packard is a world leader in Electronic Counters, as well as other major electronic measuring instruments. The 4p line includes over 250 different equipments—providing almost complete coverage of measurements that can be made electronically.

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equipped with IBM's new 704 and 709 computers, as well as smaller electronic calculators. The Portland and South centers, to be equipped with IBM's 650 magnetic drum processing machines, are expected to be in operation by mid-1960.

The company also will build a 400,000-sq.-ft. data processing machine manufacturing, engineering, and construction facility at San Jose, Calif. IBM also says that it will build a \$60,000 sq. ft. manufacturing facility at Rochester, Minn., for computers, by 1958.

Other recent announced expansions and changes in the systems industry include the following:

• **Reese Instruments Inc.**, Dallas, has purchased the business and assets of the Burlington Instrument Co., Burlington, Iowa, maker of electronic indicating instruments. The new acquisition will be transferred to Dallas and integrated with TI's Components Division as soon as possible, without interrupting deliveries to present Burlington customers.

• **United States Time Corp.**, New York, has signed a research and development agreement with Electronic Sports, Inc., Los Angeles, will carry out special research assignments in the electronics field. U. S. Time Corp. also takes a recurring option on all research authorized but assumed share of Electronic Sports, Inc.

• **Chippac Radio & Television Inc.**, New York, has purchased all subsidiary stock of David Rogers Co., New York, maker of hi-fi and consumer electronics equipment. The purchase is called "the final step in Chippac's overall plan of expansion and diversification."

• **Collins Radio Co.** has opened a South sales office to serve Northwest area, at the White House Street Bldg. 1111 Fourth Ave., C.-L. Pfeiffer is office manager.



Movable Computer

Desk size digital computer, general purpose, Model 622P-10, has magnetic drum storage capacity of 4,095 11-bit words with reserve time of 17 millionths seconds. The computer can be moved to other computers from 115 to 460 cps, and requires no air conditioning or special ventilation. Price is \$20,800. Linscotte, Inc., Cleveland, Ohio.

FILTER CENTER

► **Whe's Scared of Tumb-Nance** reports that an "upside in order" for its DME equipment has caused a 60-day delivery backlog. Nance, which recently delivered its 230th DME, has put its entire production force on a steady work, while its test department has jumped from a 40 to 60-hour work to 80-hour output.

► **Collins Integrated Package-Collins Radio Co.** is developing a new integrated CNI (communication-navigation-identification) package for the McDonnell F4H. The new CNI package, which employs modularized construction throughout, includes the basic elements of the AR-33 UHF transceiver, ARA-25 UHF direction-finder, ARN-33 (XN-10) Tacon receiver, and UHF Navstar electronic navigation, including Air Force radars, are presently interested in the Collins CNI package.

► **Nash-Tick-Air Force** has a requirement for a new type of solid state maintenance system which should not be susceptible to enemy detection or interference. Anybody got any idea?

► **AIEE Meeting—"Electricity in Aircraft"** will be the theme of the 1960 Southern district meeting of the American Institute of Electrical Engineers, at the Baker Hotel, Dallas, Apr. 24. Among the 30 technical papers scheduled for delivery are the following:

• "A New Solution to the Aircraft Rectifying Problem," C. W. Clement, Georgia.

• "Integrated Electronic System for Aircraft," Robert Olson, Collins Radio Co.

• "Integration of D.C. Power Supplies for Airborne Electronic Equipment," J. M. Murphy and H. D. Stevens, Georgia.

• "An Automatic A. C. Generating System for Aircraft," L. R. Olson, Boeing Aerospace Co.

► **Vickers Tests Soco—Evolution** tests on a new production prototype of USAM's Vickers reform-to-base computer are slated to begin around June at the Glenview County (Ill.) airport. The new unit, built by Calsky Div. of Avco, will have several innovations, including the ability to compute a reductio-ad-absurdum path for program assembly, with a wider radius turn-on factor for jets. Unit will also give automatic warning of possible altitude conflict between aircraft, with red alert lights to show the speed of early aircraft under control.

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peratures of -50C and 75C. Reported voltage value of tubes operating below 4,000 volts changes about 1% through their temperature range, while tubes operating above 4,000 volts have less change, according to says Aston Electronic Laboratories, Inc., 1226 Flushing Ave., Brooklyn 37, N.Y.

• Test pack for printed circuit boards measures only $\frac{1}{8}$ in. dia. x $\frac{1}{8}$ in. long. Device is made of brass, plated with gold over silver to provide low contact



resistance and prevent silver migration in printed circuits. Goyball Co., 501 Hillgrove Ave., LaGrange, Ill.

• Precision single-turn potentiometers, designed to permit simplified manual phasing of multi-section gangs of pots, is available in five different diameters, ranging from $\frac{1}{8}$ in. to 1 in. Phasing is accomplished by loosening clamping nut, moving internal board, then retightening. Bulletin 754255 gives full data. Chromat Manufacturing Co., Inc., Davis, N.H.

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The Bell X-2's huge power comes from a ductless ramjetted Corbin Wright rocket engine built by duct company's Propeller Division, Caldwell, N.J. This aircraft

plum was built in 1951 for the company's Buffalo, N.Y., plant. Wings and fuselage are of nickel-containing alloys — to withstand very high skin temperatures.

To explore the Heat Problem at supersonic speeds

This rocket-powered research plane, the Air Force's Bell X-2, is built to fly at high Mach speeds.

As the rates for new speed records, tremendous heat caused by air friction will test her materials at temperatures higher than conventional materials can withstand. So her designers skin is made of "K" Monel, a high-temperature nickel-copper alloy — wings of chromium-coated stainless steel — to stay strong at high temperatures.

The Bell X-2, the most high speed aircraft, when on Inco Nickel and Inco Nickel Alloys for the annual con-

struction of heat resistance, corrosion resistance, strength and ductility so necessary to safe and satisfactory performance. The Corbin Wright ductile-controlled rocket engine which powers the Bell X-2 depends upon Nickel, too, as an alloying element in many of its critical parts.

Perhaps one of the Inco Nickel Alloys can solve a metal problem for you, too. Inco's Technical Service Section is ready to help you investigate. Why not outline your problem for their study?

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is a full wave rectifier at a half wave and half wave rectifier combination. It is rated for 60 v maximum d.c. input, delivers 32 ma d.c. in full wave rectifier, and operates over temperature range of -50C to 100C. Device measures only 0.36 in. dia. x 0.78 long, and comes with gull lead leads. Bolelec SR 124 given application data. International Rectifier Corp., El Segundo, Calif.

• Acid-lead silicon rectifier, suitable for installation on printed circuit boards, is now available with peak inverse voltage ratings to 600 v, and maximum average forward currents to



500 ma at 100C. Unit occupies less than 4 sq. in. volume. Bolelec TE 1335 gives application data. Transistor Electronic Corp., Melrose 26, Mass.

• Delay lines, specially designed for use with printed circuit boards, are available to customer's requirements in small, rectangular or round housings, with leads brought out at any angle or in any position. Units are moisture and fungus resistant and can be operated at temperatures of -50C to 125C. Manufacturer's catalog describes delay lines available in standard or custom-built units. EBC Corp., 530 Bergen Blvd., Palisades Park, N. Y.

• Hydrogen diodes, Type PL-161, for pulse modulation are 1.25% smaller than its predecessor. Peak plate voltage is 35 kv, peak plate current is 325 ma. New tube measures 61 in. high, 24 in. dia. Penta Laboratories, Inc., Santa Barbara, Calif.

• Angular and/or radial tube counter, Model 1804, contains four digital

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A MESSAGE TO AMERICAN INDUSTRY • ONE OF A SERIES

After the Great Ford Foundation Gift...

What Still Remains To Be Done To Provide Decent Faculty Pay

The Ford Foundation's gift of a half billion dollars to our privately-supported colleges, medical schools and hospitals, now being distributed, is magnificent. But it will be much more magnificent if it inspires completion of the job to which it gives a lift. So far as the colleges and universities are concerned, this job is primarily to rescue their faculty members from being second-class citizens economically.

Even in a period when we have become accustomed to astronomical financial figures, a half billion dollars remains an eye-popping gift. In fact, it is so imposing that a good many people who don't read the fine print are apt to conclude that it must just about solve the financial problem to which it is addressed.

Goes Only a Small Way

However, we have allowed college professors to fall so far behind the people financially that the share of the Ford half billion dollar gift going directly to the improvement of faculty salaries (\$210 million) will go only a small way financially toward doing what is necessary to provide adequate salaries.

Completion of this job for our privately supported colleges and universities calls for:

1. An increase in faculty salaries at least five times as great as that made possible by

the Ford gift merely to restore salaries to their 1939 purchasing power level and an increase fifteen times as great to provide adequate salaries today.

2. Some difficult and courageous decisions by the heads of the colleges and universities in apportioning the grants received by them.

Terms of Gifts to Colleges

The \$210 million of the Ford Foundation gift going specifically to improve faculty salaries is being distributed on the following basis: Each of 615 privately supported, regionally accredited liberal arts and science colleges and universities receives a gift about equivalent to its last year's teaching payroll. For ten years only the income from these gifts is to be devoted to raising faculty salaries. After that all the money can be spent in any way the institutions receiving it see fit. There is no requirement that universities having other than liberal arts and science schools limit use of the gifts to improving salaries in these schools alone. They can spend it right through all their faculties if they wish.

In addition to the gift of \$210 million specifically directed to increasing faculty salaries, another gift of \$50 million goes to a group of 126 institutions selected for specially noteworthy leadership in improving

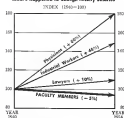


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What's Happened to College Faculty Salaries*



* Real Index before Taxes.
Source: Council for Postpaid Aid to Education, U. S. Dept. of Commerce, U. S. Dept. of Labor.

the status and pay of teachers. For these schools the individual gifts add about 50% more to the amounts coming from the \$210 million fund. They can be used to improve faculty salaries if the institutions choose to do so, but this is not required by the terms of these gifts.

The \$210 million plus the \$50 million should yield an income of \$10-\$15 million a year. Even if all this is used to raise salaries, it will be only a small step, however worthy, toward the \$200 million per year the colleges need to meet their salary requirements adequately.

Helps Some Who Need It Most

In focusing its gift to improve faculty salaries in privately supported liberal arts and science colleges, the Ford Foundation aims at least part of the help at the spot where it is most desperately needed. Numerous surveys have indicated that the most poorly paid of all college and university faculty members are those in small, privately endowed liberal arts colleges.

But the overshadowing fact is that the teachers in our colleges and universities as a whole are badly underpaid. Just how badly is indicated by the chart above which first appeared in an earlier editorial. (Figures later than those for 1934 are not available.)

The Ford gift will turn the indicator of faculty salaries, which now lies far below the general salary trend, upward a few points. And it will do this in some places where salaries are below the wretched average shown by the chart.

But the Crucial Test Remains

College and university administrators will have the opportunity to extend further the process of getting the help provided by the Ford Foundation gifts where it is most needed. In general, this will mean giving it to senior faculty members, in order to hold experienced teachers and make college teaching attractive as a career. But to make such a decision in many schools will take extraordinary fortitude.

The crucial test of the success of the enterprise of the Ford Foundation in raising faculty salaries will lie in whether it prompts the rest of us—college alumni, individuals, business firms and legislators alike—to see that it is a great beginning, not a signal for a recess.

Even with the Ford gifts providing \$10-15 million a year, our privately supported colleges and universities must have an increase of about \$190 million a year to provide decent faculty salaries.

This is a job far beyond the capacity of the Ford Foundation, imposing though that is. It is a job far beyond the capacities of a few hundred large corporations and a few thousand wealthy individuals. If it is to be done, it is a job at which all of us must work with a will.

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Photograph of the new General Electric 20 KVA hydraulic constant speed drive illustrates the small size of the 35-pound unit.

Passenger Copters Favored for Chicago

CAB examiner's report picks Helicopter Air Service, advises denying fixed-wing carrier's application.

Washington—A metropolitan passenger helicopter service has been recommended for Chicago by a Civil Aeronautics Board examiner. Helicopter Air Service Inc. has chosen to operate the airline's third passenger helicopter air line.

In his report, Examiner Joseph L. Fitzmaurice favors renewal of Helicopter Air Service's certificate for five years. The new certificate would allow HIAS to carry passengers, cargo and mail between Midway Airport and O'Hare Field, and between the two airports and the Loop in downtown Chicago.

Exemption authority for HIAS to operate between two points within a 75 mile radius of O'Hare Field is also recommended. The authority because of the 75 mile radius could not get beyond Review.

At the same time, Fitzmaurice advised the Board to deny an application of Midwest Airlines to operate a local air service in the Chicago area with fixed-wing aircraft. The report was in itself in the Chicago Area Service Committee.

First Downtown Service

If the CAB follows its examiner's recommendations, HIAS will be authorized to operate the first downtown-helicopter service with its proposed shuttle between the Loop and the airports. Los Angeles Airways and New York Airways operate in the metropolitan areas of those cities, but neither has directly to a downtown heliport.

The new service would also answer the increasing need for efficient transportation between the two airports for

passengers changing flights at Chicago. The airline began flying a part of their operations to O'Hare several months ago, and a substantial number of schedules were operated out of the new commercial airport.

In giving the airline the authority to serve Chicago through O'Hare as well as Midway, the CAB has specified that only helicopters can be served on the same flight, leaving passengers traveling between them at the mercy of ground transportation and city traffic.

Need for Service

Fitzmaurice says that the failure to serve HIAS now added authority to carry passengers would be a step backward. He feels that passenger authority will permit additional equipment, staff, larger aircraft, but the practicality of short-haul helicopter service and "tag along" the technical and economic progress of civil aviation.

There is a need for improved transportation service between the airports and downtown Chicago, the report said, and air service is the most means of accomplishing it. Midway is about 30 miles and O'Hare 39 miles from the Chicago Loop, and ground transportation through heavily congested areas takes 45 minutes to other airport.

The examiner thinks that a Loop-express helicopter service would be the best but not needed to judge the economic feasibility of the helicopter as a transport vehicle. Service into downtown Chicago would be the first option of this type serving a highly congested point.

The City of Chicago will provide facilities for helicopter service at Midway, and O'Hare, and it has a proposal under way to establish a heliport near the central business district.

For a suburban service in the Chicago area, HIAS has proposed four routes radiating from Midway Airport to Itasca, Winnetka, Evanston, IL, to Michigan City, Ind., and also to De Kalb, Ill.

The routes would be a later phase of the current development program, which probably would be served before 1978 or 1979.

Fitzmaurice feels that certificate authority for the suburban service would give a degree of permanency to the airline and warranted because of a lack of evidence of the need for it then. He recommended a temporary exemption and a flexible area-type authority which will give the carrier a chance to demonstrate its service to national traffic and changes in traffic patterns.

Sikorsky S-55 or S-58

The first phase of Helicopter Air Service's new operation would be the transport of traffic between the airports and downtown Chicago. The initial plan is to use Sikorsky S-55 or S-58 helicopters in the proposed service. New York Airways and Los Angeles Airways have used the S-55 in their passenger operations, and New York Airways has ordered seven of the large S-58s for delivery this year.

Midway Airlines proposed a passenger and freight service with fixed-wing aircraft. The Midway agreement would be to get with a shuttle between Midway and O'Hare, and would be expected to serve points in the Chicago area. The carrier would use Convair 440s and Cessna 441s. Midway has operated an air taxi service in the Chicago metropolitan area for five years.

In starting a helicopter service over a fixed-wing operation, the examiner points out that operation of helicopters between the airports wouldn't solve any congestion problems while an added fixed-wing service would aggravate an already serious problem.

The report points out that the Port Office, Department of the Defense, Department and the Federal Civil Defense Administration support construction of helicopter service in the Chicago area. The Port Office Department has been disappointed about the high cost of running the mail by other means available, but it believes that eventually heli-

copters will benefit the mail service.

The Defense Department fears expansion of helicopter services because of the valuable operations and assets more experience they develop.

The examiner refused to the 1954 Civil Air Policy Statement in support of helicopter operations. He points out the group found that existing service is inadequate for commercial operations to develop new operations and techniques for military use.

Helicopter Air Service has initial mail in the Chicago area since mid-1949. The present routes, restricted to 100 miles, include Chicago, Evanston, Itasca, Winnetka, Michigan City, Ind., and also to De Kalb, Ill. The routes would be a later phase of the current development program, which probably would be served before 1978 or 1979.

The CAB has authorized temporary passenger operations at Los Angeles and New York. The authority of Los Angeles Airways and New York Airways will expire September and New York Airways' authority expires in March of 1977.

Sikorsky has the helicopter equipment on hand about 52.8 million annually for the next two fiscal years. It is estimated that about 52.8 million in fiscal 1977 and fiscal 1978.

Helicopter Air Service's schedule has declined slightly from \$112,000 in fiscal 1974 to \$121,000 in the current fiscal year. Schedule for Los Angeles Airways has risen from \$684,000 in 1974 to \$852,000 this year, and New York Airways' schedule has risen slightly from \$1,455,000 in 1974 to an estimated \$1,485,000 in the current fiscal year.

New Message Code Used by Airlines

U. S. domestic and international scheduled airlines are to begin use of a new international aircraft message guidelines (AIRIMP) this week.

AIRIMP, which is a complete grammar and vocabulary of its own, packs all possible occurrence messages into 99 short abbreviations. The older Universal Terrestrial Recommendation Code which it replaces had 340 code words.

The latest procedure was developed last year by a joint panel of airlines and communication experts of the Air Traffic Conference of the Air Force, Department of the Defense, Department and the Federal Civil Defense Administration support construction of helicopter service in the Chicago area. The Port Office Department has been disappointed about the high cost of running the mail by other means available, but it believes that eventually heli-

Limits on Civil Transportation Of Military Detailed by Defense

Washington—Load limits and aircraft standards for transportation of military personnel in commercial aircraft have been established by the Department of Defense.

The new policy directive sets up detailed standards of service for airlines carrying military personnel in civil aircraft (CAMI). Defense also has established a table of maximum, minimum and average types of aircraft used by the carrier for CAMI traffic (see below).

Defense said it prescribed load limits to prevent overloading and to avoid the possibility of carrier releasing cargo at departure time because it has avoided the capacity of its aircraft.

The load limits are also designed to prevent "bump-bumping" flights which might interrupt loading stops because of heavy loads and put the loaded aircraft through critical loading and takeoff times several times on one flight.

The CAMI load limitations are based on an average of 66 lb of baggage and 160 lb of weight per passenger. Extra weight for the airline must be included in the passenger limitation.

When baggage weight is naturally reduced, the number of passengers can be increased up to 10% of the difference between actual and allowed weight.

Airline carrying military personnel must furnish prohibited loading zones. They are also supposed to furnish blankets and pillows on long flights. A flight attendant is supposed to be assigned to each flight.

The policy directive requires that the airline serve hot meals in the morning and evening and a hot lunch at noon. The meals are supposed to be "fresh, tasty and adequate in quantity." Breakfast is supposed to be served between 0700 and 0800 hours, lunch between 1200 and 1300 hours and dinner between 1700 and 1900 hours. Load time at the origin point governs the first meal period.

Defense doesn't want cargo to be

any necessary allowance instead of actual, and specifies that such the airlines are responsible for such but fail to do so.

In the case of transportation of service to the airlines, they must provide alternate transportation at their own expense and in lieu of a refund. In such cases, the carrier has to pay full available fuel and holding charges before military authorities volunteer to pay.

Alternate transportation is supposed to be provided in similar equipment if possible. If it is not available within 10 hours, either air or surface transport should be provided under the terms of the directive. Sleeping accommodations are specified if the delay. When passengers will make an unplanned stop between midnight and 6:00 a.m.

If a carrier has to delay or cancel a departure of a contracted CAMI for a service other than weather, military order or other conditions beyond its control, it has the same responsibility specified for delay or cancel.

Baggage and military impediments can be carried without weight allowances as long as this step under more than aircraft load limits. Loading and unloading of baggage at a responsibility of the carrier, except that where normal baggage facilities aren't available, passengers are not to be and from the aircraft.

The carrier is supposed to work the transportation officer of time and position of departure to passengers on arrival at the airport in hour before flight time.

Awakenfulness of aircraft crew positions and operating standards are left to the regulations of the Civil Aeronautics Board and the Civil Aeronautics Administration. Transportation officers are not supposed to inspect aircraft for safety and maintenance, except to point out obvious deficiencies.

Defense prefers that the airlines use pressurized equipment in operating CAMI, after factors being equal.

CAM Load Limits

Type of Aircraft	Normal Crew	Minimum No. of Passengers	Weight of Passenger & Baggage (in pounds)
DC-1 or C-47	2	22	5,000
C-46	2	22	5,000
Convair 240	2	36	5,100
Convair 440	2	49	9,900
DC-4 or C-54	3	47	15,000
DC-6	3	60	20,000
Constellation	3	54	19,000
DC-7	3	60	14,000



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Overall Height	28' 0"	28' 0"
Wing Sweepback (at 25% Chord)	30°	30°
Landing Gear Type (Fixed/Retractable)	Fixed	Retractable
Landing Gear Rating (for way to destination)	81' 1"	81' 1"
Landing Gear Components (2)	1445 sq. ft.	1445 sq. ft.
Total Volume - Both Components		

*DATA APPLICABLE TO SPECIFIC MODELS LISTED

Engines	Engine Type	Engine Type	Engine Type	Engine Type
	4-551	4-551	4-551	4-551
Design Gross Weight	280,000	280,000	280,000	280,000
Max. Takeoff Weight	280,000	280,000	280,000	280,000
Design Landing Weight	180,000	180,000	180,000	180,000
Maximum Ramp Weight	174,400	174,400	174,400	174,400
Design Zero Fuel Weight	172,200	172,200	172,200	172,200
Design Zero Fuel Weight	161,500	161,500	161,500	161,500
Design Zero Fuel Weight	154,000	154,000	154,000	154,000
Design Zero Fuel Weight	146,000	146,000	146,000	146,000
Design Zero Fuel Weight	138,000	138,000	138,000	138,000
Design Zero Fuel Weight	130,000	130,000	130,000	130,000
Design Zero Fuel Weight	122,000	122,000	122,000	122,000
Design Zero Fuel Weight	114,000	114,000	114,000	114,000
Design Zero Fuel Weight	106,000	106,000	106,000	106,000
Design Zero Fuel Weight	98,000	98,000	98,000	98,000
Design Zero Fuel Weight	90,000	90,000	90,000	90,000
Design Zero Fuel Weight	82,000	82,000	82,000	82,000
Design Zero Fuel Weight	74,000	74,000	74,000	74,000
Design Zero Fuel Weight	66,000	66,000	66,000	66,000
Design Zero Fuel Weight	58,000	58,000	58,000	58,000
Design Zero Fuel Weight	50,000	50,000	50,000	50,000
Design Zero Fuel Weight	42,000	42,000	42,000	42,000
Design Zero Fuel Weight	34,000	34,000	34,000	34,000
Design Zero Fuel Weight	26,000	26,000	26,000	26,000
Design Zero Fuel Weight	18,000	18,000	18,000	18,000
Design Zero Fuel Weight	10,000	10,000	10,000	10,000
Design Zero Fuel Weight	2,000	2,000	2,000	2,000

* All types and performance data pertain to specific models and weights indicated.
** Advanced series

ALPA Safety Forum Slated Next Month

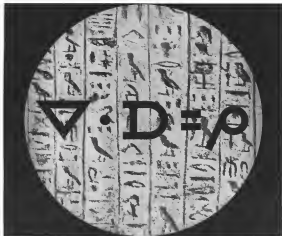
The fourth Annual Air Safety Forum sponsored by the Air Line Pilots Association is to be held in Chicago on May 6, 7 and 8 at the Hotel Sheraton.

The program for the three-day session stresses the need for better air traffic control to ensure the safe and efficient use of the sky. The need for further airport development, and other operational problems with which the airline pilots are concerned in their responsibility for safe operation of the nation's airline fleet. The panel session was scheduled,

one on air traffic control, present and future, and one on airport safety.

Charles J. Lewis, Administrator of Civil Aeronautics, will address the safety experts and aviation operators.

The Safety Forum has had three broad general purposes since the first meeting was held in 1953:
• To ensure the safety of civil aircraft.
• To ensure that the industry is kept abreast of the field of air safety and what steps be taken to maintain an acceptable level of safety.
• To provide an exchange of views between pilot safety experts and industry and Government representatives.



THE BIG STORY

Less than two million days have passed since man's first crude attempt to correlate his thinking and his knowledge with a new science of symbols and hieroglyphics.

And communication is still one of our most undeveloped sciences.

Today, something of great importance is happening at Martin in the technology of communication. It is a new method of harnessing and efficiently utilizing engineering manpower for the solution of pre-

viously impossible design and development problems.

This new operational concept now holds the key to countless closed doors beyond which lie the "impossible" achievements of tomorrow.

Already the Martin concept is revamping the calendar and the cost on top-rated projects in the most advanced areas of flight systems development. And the next frontier is space itself.

It is a big story.

Come to Martin if you are interested.

MARTIN
BALTIMORE

CAB Insists IATA Stop Race on Fares

Washington—The Civil Aeronautics Board has compromised in its dispute over international fare increases, but it still insists that international airlines raise their first class fares.

The Board has approved an 18% increase in first class fares on most ocean routes until Sept. 30. At the same time CAB asked its approval of tourist fares back from Dec. 31 to Sept. 30.

The original CAB action disappointing the fare increases caused widespread protests from the airlines and various foreign governments. The new fares go into effect April 1.

The Board and inspection approval doesn't indicate new change in its basic philosophy. It expressed concern over lack of pricing standards for first class service, lack of realistic minimum seating densities for tourist service and the absence of charges for lower services. The CAB said it is opposed to the "giveaway fare" which is reducing the costs of an airline.

In its decision, the Board outlined a number of steps it would like to have the airlines take. The recommendations are directed primarily toward airlines on the North Atlantic, but the CAB considers them applicable to the Pacific area too.

First, the Board would like to see a separate charge established for dependent seats based on a percentage of the first class fare equal to two-thirds of the fare in capacity caused by conversion to dependent configurations.

An increase in passenger charges for berths is recommended so that a berth would cost no more than the average seat charge.

The CAB favors a realistic standard of maximum seating densities for all aircraft types in service. The Board would have the airlines decide on density in domestic operations with adjustments to cover with the difference in physical operating conditions on international routes.

The Board also feels that lower fare levels should be revised in an effort to eliminate an subsidization of first class service with tourist revenue and reflect savings from application of reasonable minimum standards for the service to be supplied at basic fares.

A warning was issued that the CAB will not approve fares until Sept. 30 unless airlines which don't reflect the principles it has described. The Board said it realized the airlines are faced with an open rate but it believes a solution of the problem important enough that it is prepared to accept the consequences of an open rate situation.



PROTOTYPE of the SE-310 Concorde makes wing pit tour, while Boreas Super jets are added in the U.S. lifts its nose into air for takeoff during company flight today.

French Caravelle on Takeoff



MAIN LANDING WHEELS of Caravelle prototype have ground. Nose and guards at rear of wheels to protect Boreas Avco RA29 engines along fuselage from being debris.



CARAVELLE, which has a cruising speed of 430 mph, takes its air from turbo engines. Later models will be powered by conventional Rolls-Royce Conquest turbine engines.



• Last December, Continental Airlines ordered 18 Vickers Viscount 810-840 aircraft for delivery in 1956. Continental has now increased its order to 24 aircraft with an option for an additional five.

the new turbo-prop

VISCOUNT 810-840

cruising speeds up to 400 miles per hour!

The new Viscount 810-840 is designed to cruise up to 400 miles an hour at 30,000 feet. Yet it will be even more economical and profitable to operate than the famous Viscount 700 series, which has set new speed and traffic records for progressive airlines all over the world.

The Viscount 810-840, with a capacity of up to 70 passengers, will be the ideal aircraft for medium-haul, high-density routes. Its advantages include higher productivity because of higher speed; expanded seating capacity;

greater entry into the air through its advanced Rolls-Royce Dart H. Ets. 7 and R. Ds. 8 turbo-prop engines; and relatively low first cost.

Behind the new Viscount 810-840 stands the great name of the Vickers Group—internationally famous as makers of aircraft, ships, industrial machinery and precision equipment.

Circuit Sales Representative: Christopher Clarkson, 10 Rutledge Place, New York 20, N. Y.

turbo-prop
VICKERS VISCOUNT

VICKERS-ARMSTRONGS (AIRCRAFT) LTD.
Weybridge, England

Airline Traffic—Fourth Quarter 1955

	Domestic Passengers	Revenue Passenger Miles (RPM)	Load Factor	U. S. Mail Ton-Miles	Express Ton-Miles	Freight Ton-Miles	Total Revenue Ton-Miles	Per Cent Revenue to Available Ton-Miles	
DOMESTIC TRUNK									
American	1,520,212	3,072,841	47.38	9,100,738	3,290,763	18,136,233	131,638,291	62.66	
Boeing	483,621	131,893	29.13	401,716	429,463	921,962	10,665,480	51.89	
Capital	325,761	184,805	39.29	732,440	791,521	1,184,845	21,477,123	65.06	
Continental	36,099	23,217	47.16	47,019	26,136	182,598	5,118,992	48.73	
Eastern	568,558	58,431	52.61	258,515	10,737	354,911	6,398,379	15.94	
Delta	519,519	221,312	44.80	969,333	816,831	1,456,572	21,415,714	37.13	
Eastern	1,445,441	551,736	37.16	3,009,826	1,664,518	8,180,791	90,998,186	18.34	
Norfolk	871,634	110,473	12.55	1,046,711	539,507	1,787,936	11,068,217	58.98	
Northeast	126,118	71,303	56.46	60,219	32,194	71,246	2,460,410	38.36	
Northern	221,311	114,110	51.59	3,109,612	737,009	2,008,604	23,413,838	32.88	
Trans World	639,143	139,711	28.50	3,327,812	2,633,133	3,027,149	54,867,101	38.24	
United	2,312,233	338,181	18.61	2,079,345	5,183,099	8,562,864	191,863,232	56.45	
Western	212,131	127,683	56.10	107,391	251,196	649,126	12,439,634	53.49	
INTERNATIONAL									
American	32,147	89,769	63.95	91,859	9,232	697,431	2,925,128	64.68	
Boeing	7,633	16,323	16.64	199,639		238,540	3,196,877	58.61	
Continental Atlantic	21,956	2,464	10.70	3,999		16,781	299,683	14.27	
Colonial	5,114	3,970	15.59	892		16,717	649,535	19.27	
Delta	11,816	13,297	11.22	26,735		391,140	2,601,212	39.92	
Eastern	45,999	54,093	16.99	261,536		218,745	7,129,639	30.99	
Norfolk	22,815	14,794	52.56	27,186		191,291	1,846,915	51.58	
Northeast	22,532	43,742	18.85	3,199,461	37,116	1,856,339	16,136,952	61.89	
Pan American									
London	37,333	37,381	62.78	131,154		775,695	3,736,962	54.85	
Adelaide	136,896	232,122	32.39	2,279,431		4,173,936	34,776,503	41.21	
Panama	37,273	94,192	65.31	5,553,089		3,653,463	35,380,761	66.69	
Latin America	243,963	223,776	91.54	1,127,273		9,613,136	32,938,739	58.80	
Panama	31,269	38,393	50.66	113,145		512,172	3,576,739	32.60	
Texas World	36,459	327,654	51.81	2,856,143		2,894,214	18,902,322	87.23	
United	18,495	46,755	47.69	316,984		138,131	2,275,266	61.25	
LOCAL SERVICE									
Allegiance	64,376	35,753	47.87	53,799	65,549		1,601,488	45.29	
Bonanza	20,331	6,314	39.16	62,161	7,540		688,761	37.89	
Central	23,567	4,176	29.44	18,191	6,142		15,625	424,362	27.40
Frontier	61,296	82,612	48.66	36,729	23,252		234,173	1,254,171	27.34
Lake Central	29,162	4,839	34.72	4,273	42,331		605,732	34.65	
Midwest	19,791	16,639	59.18	16,438	21,811		29,377	1,081,457	38.28
Norfolk Central	114,110	16,467	19.18	59,513	97,917		1,225,165	12.19	
Omaha	68,029	16,497	30.32	18,153	54,775		1,045,442	36.31	
Piedmont	95,942	17,866	32.91	49,477	39,138		1,896,214	52.68	
Southern	42,991	7,105	49.79	27,837	42,160		776,954	17.13	
Southeast	64,678	12,969	20.26	22,662	14,388		32,149	1,000,801	32.32
Trans Texas	44,680	9,561	39.92	49,628	29,756		41,961	1,964,212	37.16
West Coast	46,373	7,880	48.39	39,137	6,790		15,996	787,864	48.19
HAWAIIAN									
Honolulu	91,609	12,415	36.14	16,149		389,468	1,533,710	38.99	
Trans Pacific	41,393	5,235	17.19	4,680		27,007	111,267	47.79	
CARGO LINES									
American Mail						2,008,120	2,940,329	68.17	
Express						17,998,189	22,626,691	77.19	
Black						19,313,221	16,432,621	73.18	
REAR						8,414,265	4,948,811	39.56	
HELICOPTER									
N. Y. Airways	1,314	161	63.82	3,267	4,403	9,462	27,627	35.91	
Los Angeles Airways	1,587	61	30.36	16,580	5,894		35,195	36.58	
Helicopter Air Service				6,917			6,917	68.72	

Compiled by AVIATION WEEK from Airline reports to Civil Aeronautics Board.

NEW DEVELOPMENTS IN SUPERSONIC AIRCRAFT CREATE MANY ENGINEERING OPPORTUNITIES

In Flutter, Vibration, Electronics and
a Wide Range of Other Specialized Fields

New developments in supersonic aircraft present many vital problems. Problems in high speed research, design and test in vibration, flutter, electronics, aerodynamics and many other fields are just a few you can help us solve.

We are now conducting flutter and vibration analyses on current and advanced designs of supersonic and hypersonic airplanes. In the electronics field we are formu-

lating and trying to solve aerodynamic problems.

Opportunities in our other engineering departments offer you a wide scope for your talents at North American. Enjoy the individualism and team spirit we offer. Work with engineers who respect your opinions and professional status. Check over our list of openings below and get in touch with us. It will be well worth your inquiry.

Immediate openings for:

Flutter, Aerelasticity and flutter analysis are being conducted to current and advanced designs of supersonic airplanes. Experience and capability in independent flutter analysis projects required. Advanced degree desired, but not necessary for men with capable background.

Structural Engineers
Mechanical Engineers
Aeronautical Engineers
Research Engineers
Aeronautical Engineers

Structural Engineers
Mechanical Engineers
Aeronautical Engineers
Research Engineers
Aeronautical Engineers

Structural Engineers
Mechanical Engineers
Aeronautical Engineers
Research Engineers
Aeronautical Engineers

Structural Engineers
Mechanical Engineers
Aeronautical Engineers
Research Engineers
Aeronautical Engineers

General Lee Sternstein, Engineering Personnel Office, Dept. 66-AM
North American Aviation, Inc. Los Angeles 45, California

NORTH AMERICAN AVIATION, INC.

NORTH AMERICAN HAS BUILT MORE AIRPLANES THAN ANY OTHER COMPANY IN THE WORLD



CAB Orders

(Feb. 5 Feb. 11)

GRANTED

For American World Airways in flight to tropical service at Charlotte, N.C., St. Thomas, Virgin Islands and again to the Caribbean and South America.

Capital Airlines permission to serve Chicago through O'Hare Airport, providing O'Hare and Midway Airport are not used on the same flight.

Defense Air Transport Administration and the Department of Defense permission to discuss an agreement between various airlines and the Air Force relating to the Civil Reserve Air Fleet program.

Golden Airlines in extension of its enroute authority to operate between Chicago and Honolulu, Alaska, via Cape Cod, Seattle, Alaska, and Denver, provided Golden does not schedule flights between Anchorage and Seattle and Fairbanks, and does not schedule Sunday flights between Denver and Fairbanks. The authority is effective until 60 days after a decision is reached on Golden's application for certificate amendment as the re-creation of Delta Airlines.

SAB Airlines in extension to charter a DC-6A, aircraft to Pacific Airlines.

Southwest Airlines permission to serve Chicago through O'Hare Airport, providing O'Hare and Midway Airport are not used on the same flight.

Southwest Airlines authority to expand

service at Fairchild-Roseville, Calif., until the airport facilities are suitable for use by Southwest.

Southwest Airlines in extension to operate operations in a large range of cities for 90 days or until 70 days after rights have been obtained for Southwest to operate scheduled service over its established route, whichever occurs first.

APPROVED

Agreements between various airlines signed by the International Air Transport Association to North Atlantic specific carrier routes.

Agreements involving the American World Airways, Canadian Pacific Airlines and various other airlines relating to other carrier agreements.

ORDERED

Southwest Airlines certificate amended to allow the carrier to serve Walla Walla, Wash., and other points on August 4 on flights to NACAB Idaho.

Consolidation of several airlines with the International Air Transport Association, and extension of a review of Part 292 of the Economic Regulations.

Business Air Lines application for the Las Vegas-Hollywood service included in the proposed domestic control case.

DISMISSED

Protestant Airways petition to amend the basic fare system and rules, since the Board has no jurisdiction in connection with the Board's petition for assignment or referring to the Southwest protest case, since the Board regards it as a success.



Wide-Step Loading Stand

This second loading stand has four-foot-wide steps permitting foot-enclosing or shoe-enclosing of passengers. Adjustable folding steps in the platform allow the stand's height to be adjusted to any DC-6, DC-7 or Constellation type plane. The stand is mounted on 14-in. wheels for easy handling and weighs 8,280 lb. The stand is manufactured by the Aircraft Equipment Co., Box 305, Miami, Fla.

patron for comprehension. Vice Chairman Joseph F. Adams designed with the capacity and would consider the project.

DEFERRED

Provisions for reconstruction of a CAB decision, during exception authority for service between Chicago, N.C. and Chicago, Ill. by the Civil and Commercial Air Commission of Chicago, Delta Air Lines and Eastern Air Lines.

Shortlines

Allegiance Airlines started its first air freight service that month. Service was inaugurated at 15 stations and will be expanded later. Allegiance has decided to go back to reorganization May 1.

Agila Airways has been authorized to operate a new flying boat service between Southampton and Los Angeles in the Central Islands. The service will be operated by weekly with Short Sea-Less equipment.

Caribbean has become the 67th member of the International Civil Aviation Organization.

Island's Civil Aviation Dept. has allocated about \$400,000 for development of the American Airport this year. The staff will be increased substantially to improve night operations.

Italy, the Italian airline, has announced a five-year expansion program calling for more flights between Rome and New York and extension of its Rome-Tokyo service to Colombo and Tokyo. It also says it will be operating helicopters on the North Atlantic in 1957 and helicopters in 1960. The Italian carrier didn't specify what types of turbine aircraft it will use.

Lufthansa, the German airline, will add a third daily flight to London in April.

Miami International Airport handled more than 3 million passengers last year, including 753,351 international and 2,246,731 domestic passengers.

Netherlands Government has decided to buy a Fokker F-27 for the use of the local ferry to replace the Dakota they use now.

For American World Airways is trying out an air and baggage destination scheme with the U.S. Customs Service. A six-week test is being made at Miami on certain flights from the Caribbean and South America in which a passenger's baggage is more than \$100 in purchase, a gallon of alcohol

beverages at 100 cents can make an odd dollarization in the bar, even out of the country 45 cents. This category covers 75% of returning residents, according to FAA.

► **Phoenix** will get local airport traffic control when a planned city-federal project at Sky Harbor Airport is completed.

► **Rhode Airlines** started its express service this month under authority granted last November in the North-South air-rights case.

► **Sabena**, the Belgian airline, has decided to buy another Boeing 707. International jet transport for delivery in June 1980. The order will give Sabena a total of four 707s.

► **Seaboard and Western Airlines** flew 1,000,000 freight ton miles in January, an increase of 30% over January, 1978.

► **Silver City Airways** will start serving the Channel Islands from England this month with a daily flight carrying freight, vehicles and up to six passengers.

► **Swissair** has signed an interline agreement with Aeroline, Russia's state-owned airline. The two airlines have common transit points at Prague and Vienna.

► **Turkish Airways** aircraft will be required to back into the airport at Istanbul under an agreement negotiated between the two countries. The American operated plant is owned by the Israeli government.

► **United Air Lines** reports record traffic figures for January, with 132,399,000 passengers, a 14% increase. Express traffic was also up 14%, freight rose 7% and mail traffic increased 10.5%.

► **Vancouver International Airport** has filed 554,000 passengers but will not add 546,700 tons landing fees and other charges. The airport earned a \$17,800 profit to the City of Vancouver.

► **United Air Lines** is substituting its new DC-68s for DC-6s in each service to Honolulu from Los Angeles and San Francisco. These DC-68s can carry 75 passengers in two-class seating. By March 23, United plans to operate all 12 of its weekly coach flights to Hawaii with DC-68 equipment. United now offers an advance passenger car rental plan in conjunction with Avis Rent-A-Car station at all points served.

COCKPIT VIEWPOINT

By Capt. R. C. Robson



The Communications' Burden

To control air traffic at it returns to secure position reports from aircraft. To avoid clutter opening, in case of heavy traffic, these reports must be more numerous. From the pilot's viewpoint, however, these radio contacts can be too numerous at times, especially on those times needed for other cockpit duties.

In an effort to illustrate this matter, I refer him to the New York area. I have a special gripe against the region, it is simply a question of using statistics of which I have first-hand knowledge.

Take a flight from Washington, D.C. to LaGuardia Field. You are over the Potomac (N.Y.) the center—32 miles southwest of LaGuardia—a normal reporting point. Next, the flight can proceed to the Colts Neck, some 10 miles (about Potomac) and thence to the Flatbush test center.

Harried Tuning

But occasionally ATC will direct the pilot to LaGuardia via the north-west corner of the LGA low frequency range (Gross Army 3) which intersects Flatbush. Now the flight will not pass directly over the Colts Neck, must as the pilot may be asked to report over Regan intersection. In order to report Regan, the pilot must tune to the Allentown LF range. A map shows that Regan is located about 5.7 miles past Colts Neck, on the LF arrow. But this is a theoretical map location. Actually, due to the width of the Allentown "leg," the arrow and Regan are nearly inseparable. Therefore, the two points are perhaps 45 seconds apart.

The question arises, "Why can't we forget the theoretical 45 seconds and eliminate a cockpit chore (tuning to Allentown) by simply reporting, 'Colts Neck'?" At this point, the pilot is only a few minutes from LGA and additional radio tuning is not welcome.

Two or three minutes later the flight may be asked to report over Covey (near) intersection. Covey is theoretically 4.4 miles from Flatbush. Direct must be made as the LaGuardia approach is controlled by Flatbush and with LGA tower at Flatbush. So to report Covey, the pilot must tune to the Newark LF range (which he would not otherwise need) at a time when his radio should be positioned for an instrument approach. Or top of the list he is being asked to report to three different points in the space of a bare one minute!

There is a feeling among pilots that some of these situations could be eased if controllers were aware of the extra burden such report puts on the cockpit. In some cases radio work can't be reduced but enough to keep up with required communications.

Diminishing Returns

Each radio is a form of noise, "normal" radio facilities and must be more versus reporting points have become "standard."

A pilot must plan ahead and determine which facilities he must tune to and the sequence of this tuning. When ATC requests a report which requires tuning to an "unusual" station or when pilots must locate an "obscure" place on a map when time is needed.

Since our communications system is overloaded today, with no means to reduce it in sight, is it not possible that the situation could be eased by whittling here and there? For instance, could each center re-examine their requirements and make sure that each report is urgently needed? It is reasonable that in our efforts to move more traffic, we frequent proper reports we are actually slowing down the process. We can have a word of diminishing returns. One thing certain, our selection in the radio work will certainly be appreciated in the cockpit.

ENGINEERS

NEW 2-FOLD RETIREMENT INCOME PLAN

for Aviation and Missile Engineers

It's natural that a long-time leader in aviation, like Republic—with many fruits to its credit—should be a leader, too, in providing for the welfare of its staff. Right in line with this forward-looking policy is the remarkable new Republic Retirement Income Plan. Here is how it works:

PART 1 is a basic Retirement Income plan paid for entirely by Republic Aviation.

PART 2 is a cooperative effort. It is completely optional. But if an engineer wishes to increase his retirement fund, by making a small monthly payment, Republic will MORE THAN MATCH his contribution.

Take the case of a hypothetical engineer who joins Republic on January 1st, 1958, averages \$8,000 a year for 16 years; then retires aged 68. If he elected PART 2 of the plan, he will have a total yearly retirement income of \$22,565, including his social security. For this he himself will contribute only \$8.20 a month to the Republic Retirement Income Plan.

Of course, the MORE YOU EARN, the HIGHER your Retirement Income will be. And Republic pays a top salary scale in the industry.

...RETIREMENT PLAN JUST ONE OF MANY PLUS FACTORS POINTING TO A REPUBLIC CAREER

FIRST—there's the interest and prestige of working for a pioneer in aircraft design, creator of such famous planes as the F-4 Phantom, the F-4E Phantom II, RF-4 Phantom II, Thunderbolt and XF-88. (Don't be fooled on the production line by the new F-105, F-36 and XF-105.)

SECOND—the company is expanding sharply, providing frequent opportunities for able men to advance. In fact a \$12,000,000 increase in the Research and Development Program has just been announced.

THIRD—an All-Expense Paid Education Plan for qualified engineers living outside the New York City and Long Island areas, which makes it easy to move to Republic. Other liberal benefits: Life, Accident and Health Insurance; Hospital-Surgical Benefits for the whole family; educational aid covering 5% the cost of college and graduate study.

Serve your own best interests. Make full inquiries into the many advantages of joining Republic now, not the best of which is being on long Island—the Playground of the East.

Important engineering positions are now open at all levels:

STAFF ENGINEERING	SYSTEMS	ELECTRO-MECHANICAL	STRESS
PRELIMINARY DESIGN	MATHEMATICAL	DESIGN	AIRCRAFT DESIGN
DETAILS/DESIGN	ANALYSIS	FLIGHT TEST	WEIGHTS
WEAPONRY SYSTEMS	AERODYNAMICS	RESEARCH	DESIGNERS
PROPELLERS	TECHNICAL WRITING	TRUCK/DYNAMICS	Electrical
OPERATIONS RESEARCH	DYNAMICS	FLIGHT & VIBRATIONS	Aviation

Please address complete resume outlining details of your technical background to:



REPUBLIC AVIATION

AIRCRAFT
Assistant Chief Engineer, Administration—Mr. E. L. Steiner
Parametree, Long Island, N. Y.

MISSILES
Associate Chief Engineer, Mr. Robert E. Schaefer
Parametree, Long Island, N. Y.

ENGINEERS and DESIGNERS NEEDED

for:

MISSILE GUIDANCE
SYSTEMSBOROMING NAVIGATIONAL
COMPUTER SYSTEMSNEW CIVIL AVIATION
PRODUCTSJET AND TURBO-PROP
ENGINE CONTROLSAIRBORNE FIRE
CONTROLS

GM CAREER OPPORTUNITIES IN

Systems Engineering and Analysis
Experimental Engineering
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AND WE ALSO NEED

DESIGNERS • CHECKERS • LAYOUT MEN

Positions Are Permanent Excellent Advancement Opportunities
Every inquiry treated confidentially and given
immediate attention and personal reply.

WRITE TODAY FOR EMPLOYMENT APPLICATION

Mr. John F. Hollinger
Supervisor of Talent Personnel

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THE ELECTRONICS DIVISION

GENERAL MOTORS CORPORATION

Milwaukee 2, Wisconsin

Flint 2, Michigan

AIRCRAFT STRUCTURAL ENGINEERS

with experience in:

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- Structural Testing
- Equipment Mounting Techniques
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You will find a clear field for advancement at Raytheon where complete aircraft weapon systems are being developed.

Positions with wide responsibility and authority are available to experienced creative aircraft engineers.

RAYTHEON MANUFACTURING CO.
WAYLAND LABORATORY WAYLAND, MASS.



- Full tuition paid for approved educational program
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At Raytheon's new Wayland Laboratory Area, we have a team of experienced engineers working together as a team to create the nation's advanced weapons which will enhance Raytheon's reputation for "Excellence in Electronics".

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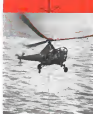
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